THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXIII. No. 1611.] LONDON, MARCH 27, 1894. [46TH YEAR. PRICE 6d.

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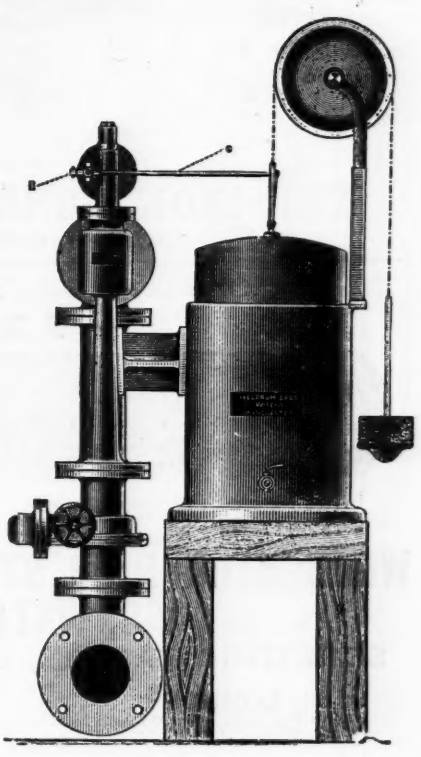

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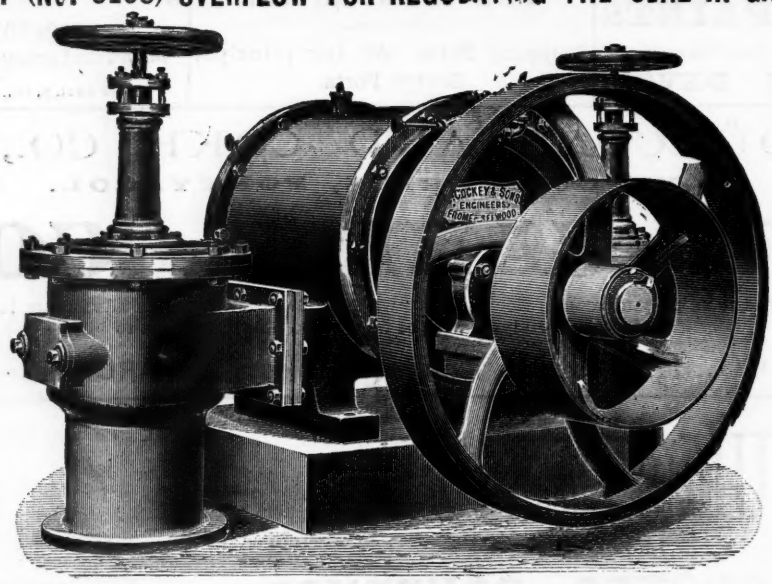

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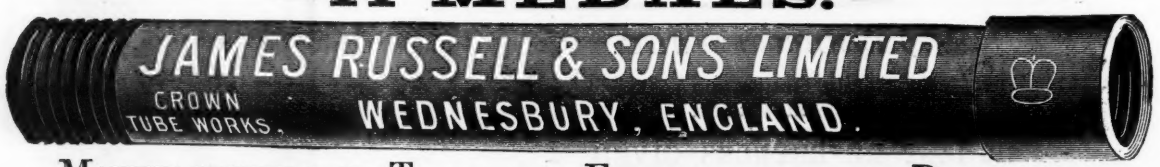

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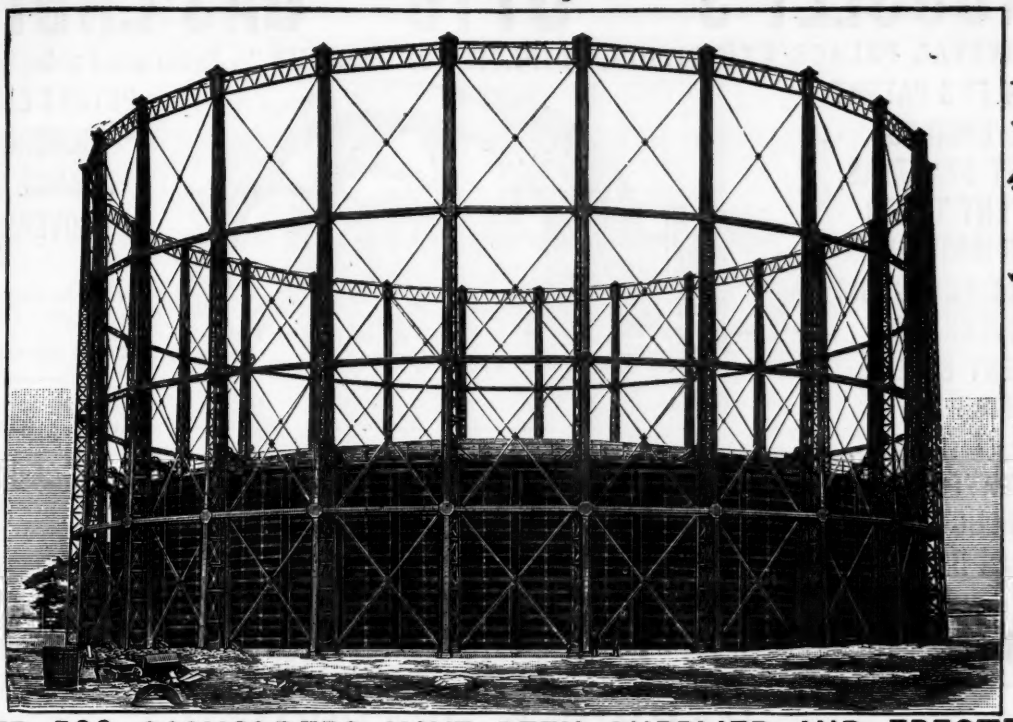

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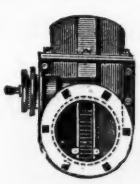

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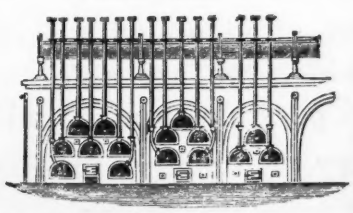

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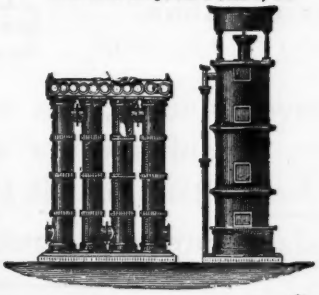

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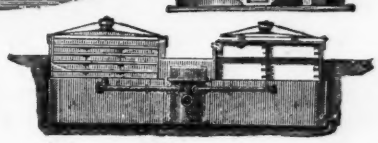

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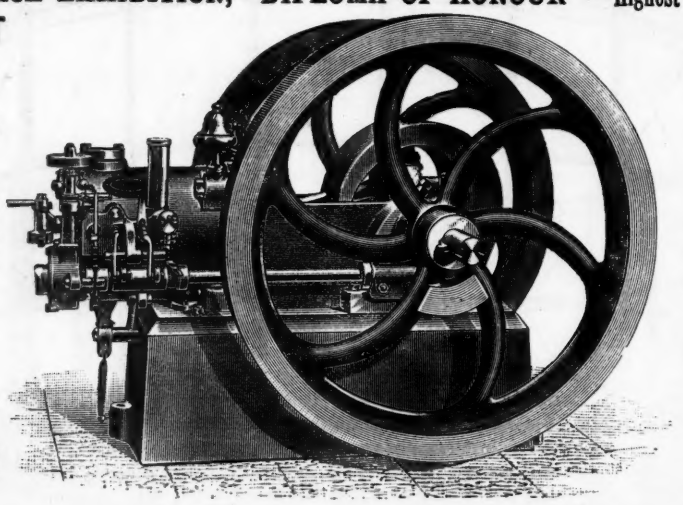

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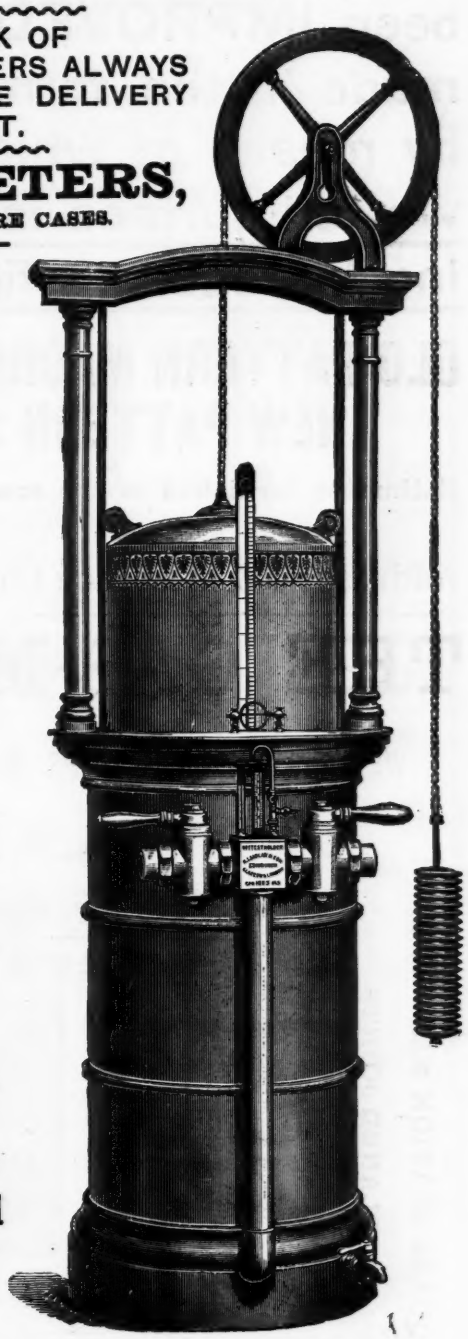

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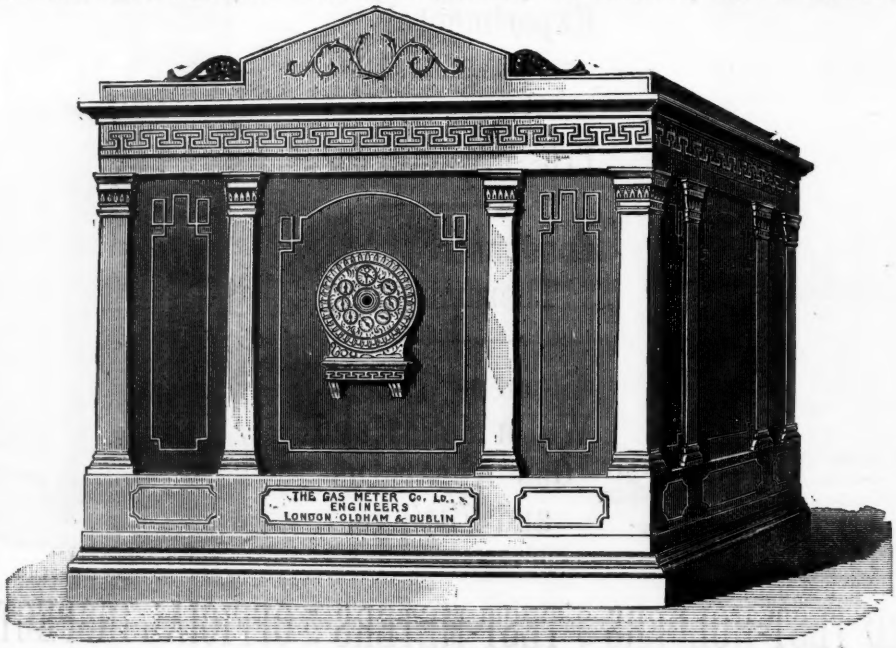

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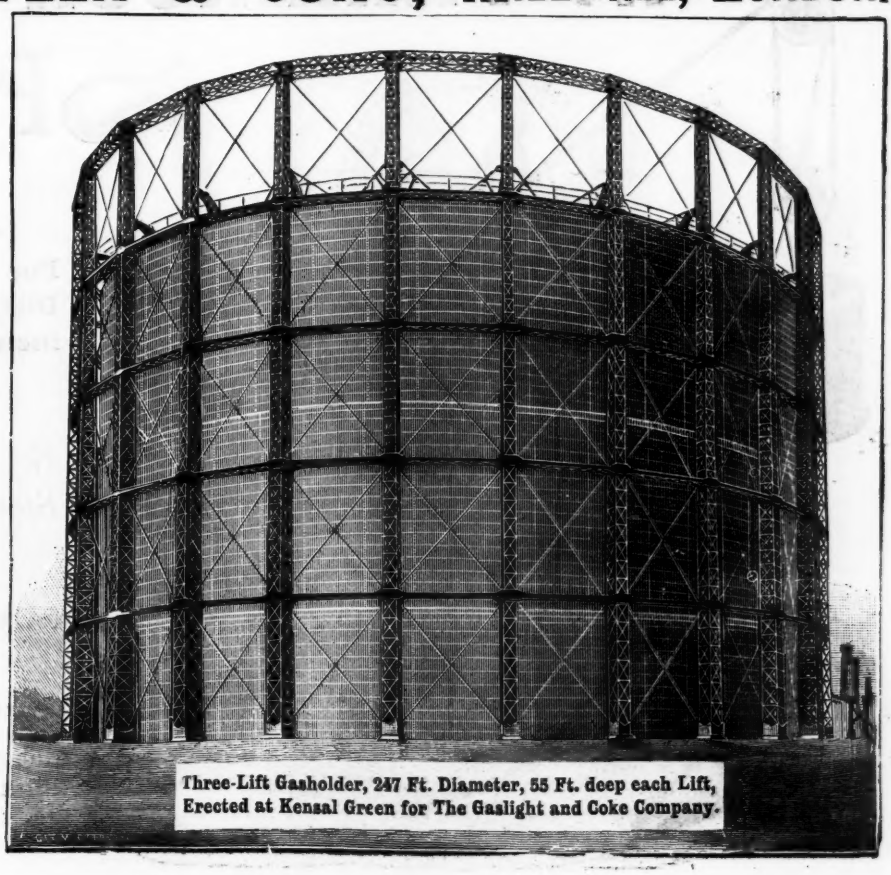

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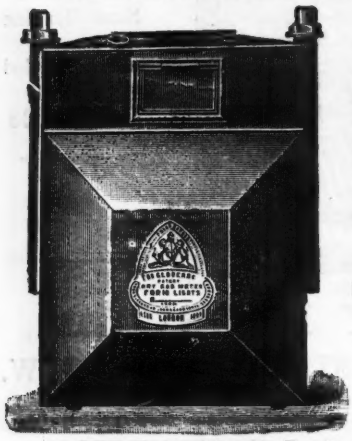

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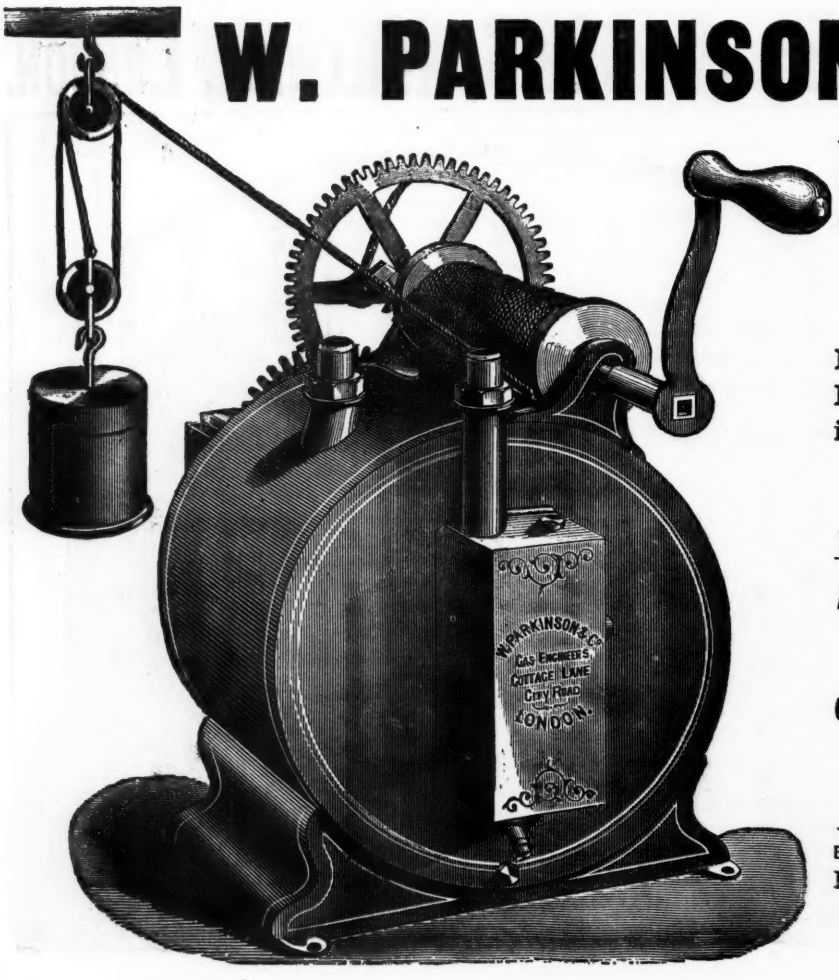

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TUESDAY, MARCH 27, 1894.

The Premier on Betterment.

ONE of the events of the past week was the speech of the Earl of Rosebery, to his colleagues of the London County Council, on social and municipal problems. The occasion was a meeting in St. James's Hall, on Wednesday last, organized by the "Progressive" party of the County Council, with the object of presenting a congratulatory address to the new Premier. Whatever else may be said of Lord Rosebery, it cannot be denied that he never yet failed to rise to an opportunity of this kind. His address was just what it ought to have been; and the adroitness with which in some passages the speaker contrived to warn his friends of their little failings under the cloak of compliments upon their good points, was really magnificent. We have no concern with the bulk of this oration; but some of Lord Rosebery's words touched upon matters habitually discussed in these columns; and we shall therefore take passing notice of the Premier's opinions on these subjects.

It may be gathered with satisfaction from his Lordship's observations in regard to the work of the London County Council that he is not in favour of largely increasing the powers of this and similar authorities of recent standing, until they have proved their worthiness by doing good work within their original sphere. He said nothing about the transfer to the County Council of the responsibility for the lighting of London; and he is evidently inclined to "make haste slowly" in the matter of the water supply. He praised the Council for having adopted the policy of disestablishing the middleman in regard to the carrying out of public works; and to this attitude we have no objection—having frequently admitted that the rule of the "general contractor" is passing away. When he came to deal with the thorny subject of Betterment, the Premier evidently felt himself upon treacherous ground. He remarked of the principle that it is not new—having been established so long ago as the reign of Charles the Second—and "was in operation during the clearances that followed the Great Fire of London." It was, however, admitted that, "for good and sufficient reasons to those "concerned, that principle has been allowed to lapse." This historical reference does not square with the statement of Mr. A. Baumann, in his book on the subject, that Betterment is of American origin. If Lord Rosebery is to be followed on this point, it will be perceived that, like so many other so-called Americanisms, this principle is only an old English relic that has been preserved until this time by the strong conservatism which is so marked a characteristic of the American social system. The fact of a principle of taxation having been in operation in the days of the Stuarts is, however, not sufficient reason for reviving it, especially when it can be said of it that its lapse was "for good and sufficient "reasons." The Premier felt this; and accordingly he lightly passed from ancient history to latter-day instance—citing the pending Bill of the Manchester Corporation, which contains a clause contemplating the enactment of the principle of Betterment, as evidence that the idea is gaining in favour. We had not previously studied the provisions of this Bill, which is of the usual municipal "omnibus" character, and ranges from the legalization of agreements between the Manchester Corporation and the capitular body of the city down to the prohibition of one person from acting as driver to more than one cart. Into the midst of these varied solicitudes of the Corporation is slipped a clause "to make provision "for the payment to the Corporation, by the owners, "lessees, and occupiers of all or some of the lands or "property which may be improved or benefited by or in "consequence of the exercise by the Corporation of any "of the powers of the Act, of such sum or sums, and "either in gross or by annual or other periodical payments, "and in such manner as may be prescribed or provided "for." The fact of the betterment, and its amount, are to be ascertained by arbitration. It must be conceded that the Premier distinctly scored by referring to this proposal of the Corporation of Manchester; and it will be worth noting how they speed in the matter.

A Trading Corporation with a Soul.

NOTHING is more common in these times than to hear a general condemnation of the methods of modern trade. Outside protected industries, like that of gas supply, there is often stated to be nothing but a howling wilderness ravaged by cutting competition, preventing honest dealers from making a living, and fostering all manner of evil practices as between bargainers, and cruelties as between employers and employed. This being almost a commonplace of the age, it is quite refreshing to read the speech of the Chairman of a certain limited Company engaged in the wholesale confectionery trade—than which there can scarcely be one more exposed to competition in every shape and form—in which the speaker declares that the business of the firm has really been built up on quality, that the firm have no intention of cutting below a working margin in any article, and in a general way that they mean to get such a price for their goods as to enable them to pay a fair dividend, and keep their workpeople in reasonable comfort. "The policy of cutting is "probably only another name for sweating, as, if the

"goods are sold to the public without a reasonable "margin of profit, it means in the long run bankruptcy "to the dealers or manufacturers, and living misery and "ultimately the workhouse for the workmen connected "with them." And this bold speaker is not afraid to hold such language in the face of those who would persuade themselves that the sterling old English merchant is a myth, and that modern employers of labour have no interest in the well-being of their employees. Better still, the man who talked thus was able, with his next breath, to recommend the declaration of dividends after the rate of 6 and 10 per cent. per annum upon the Company's preference and ordinary share capital. It is worthy of remark that this successful business is worked upon a profit-sharing basis, and that one-third of the net profit balance was disposed of to the workpeople in accordance with the scheme. The worthy Chairman was delighted with this result. He quite anticipated the objection which might possibly have been taken by some shareholder, to the effect that this money might as well be distributed among the proprietors, by asking if it would have been earned. "When introducing the scheme four years ago," said the Chairman, "I ventured to predict that your dividends "would not be diminished. And they have not only been "maintained, but (what is more) the business has been "strengthened by the goodwill and hearty co-operation "of our staff and employees generally; and to them we "owe mainly our continued success." Although the speaker did not make any claims to philanthropy, he went on to observe that the shareholders whom he was addressing might reasonably take credit for helping to solve "the "great question of social reconcilement." They have not been solely and entirely actuated by sordid motives, though the transaction in question has turned out to be thoroughly good business. Then, although the firm do not profess to be above the worries and harassments incidental to the conduct of a factory containing 1500 hands, they have the comfort of believing that, when any question does arise with their workpeople, "there is a latent spirit of reason-"ableness begotten of the idea that, after all, their inte-"rests and ours are identical, which renders the solution "of such questions much easier." The general conclusion of the speaker was then expressed in the following energetic terms: "I firmly believe that in profit-sharing is to "be found the true solution of the capital and labour "question. Collectivism may look very well in theory; "but while men are born with different physical and "mental capacities and ambitions, individualism, com-"bined with justice to all, as exemplified in profit-sharing, "is, I am convinced, the system whereby we may arrive "at the greatest common good." This gentleman evidently has the courage of his opinions. He hit the Socialists a shrewd blow when he proceeded to say that he doubted "if anyone who has ever had much to do with the busi-"ness of the world has become a Collectivist." Such an observation is just. The whole tenor of this remarkable address is such as to persuade the reader that the cheap gibe about the soullessness of trading corporations, is not universally applicable.

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The General Director of the German Continental Gas Company, Herr W. von Oechelhaeuser, usually manages to treat in a philosophical spirit the multifarious influences that affect from year to year the important undertaking over which he so ably presides; and the abstract translation of his report for the past year which is given in another column, will be found replete with curious interest. To begin with, it will help to reassure many timid gas proprietors in this and other countries to learn from this unimpeachable authority that the total gas production in the large number of towns supplied by the Company, which are scattered all over a wide region of Central Europe, exhibits an increase for the year of 4·97 per cent. The increase for the previous year was 3·10 per cent. No further evidence is needed to show the strength of the gas industry in Europe. The conclusion deducible from these figures is reinforced by the statement that last year the Company registered an increase of 6·48 per cent. in the number of burners in use by their consumers; this being the largest annual addition to the number since the foundation of the Company in the year 1856. The fact speaks volumes for the Administration of the undertaking; as, like all concerns of the kind based upon the concession system, they are constantly exposed to the risk of losing their connection by the expiration of treaties with the municipalities. From a purely technical aspect, moreover, the fact that the number of gas-burners in use increases in a greater ratio than the output of gas, is susceptible of a peculiarly interesting interpretation. It means that the annual consumption per burner is falling, and Herr von Oechelhaeuser is ready with his explanation of this circumstance, which is no other than the rapidly-growing popularity of the incandescent gas-burner. He is fully prepared to make the necessary correction of the gross returns of gas consumption on this account, and

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WATER AND SANITARY AFFAIRS.

THE recommendation of the Water Committee of the London County Council, that those members of that body who hold seats in Parliament should be requested to vote against the three Bills of the London Water Companies on the motion for the second reading, and to "take all possible steps" to ensure the rejection of those measures, was adopted last week, in the face of a vigorous remonstrance from a County Councillor who is himself a Member of Parliament. Mr. Boulnois, who thus spoke, was supported by Mr. Beachcroft; but, of course, their united arguments had no more practical effect than as constituting a protest against the selfish policy espoused by the majority. If the Council cannot get possession of the water supply on their own terms and conditions, they will do their utmost to prevent the Companies raising any capital to extend their works. The aggrandisement of the Council is the object to be kept in view, whatever risk the interests of the public may incur. We have warned the Council that they are not making things safe for themselves. If, through their opposition, any catastrophe befalls the water supply, London will not speedily forgive them. The Irish vote may aid them in Parliament; but it will not help them before the tribunal of public opinion. The schemes of the Southwark and Vauxhall Company and the East London Company, which are coming before Parliament, are founded on a real necessity besetting the water supply of the Metropolis; and the Money Bill of the West Middlesex Company has a similar warrant. Opposition on second reading is the miserable device of a party unable to meet the case on its merits. The evidence in support of the Bills may be irresistible; but precisely for this reason the Council are determined that it shall not be heard, if they can by any means accomplish that end. Parliament, if wise, will insist on knowing what it is called upon to reject; but our senators are not always wise, or the County Council would not expect to find the Legislature playing into its hands. As mentioned in our columns last week, and confirmed by the report which appears elsewhere, the Water Committee have sent a communication to the Companies, asking whether they would enter into negotiations for the sale of their undertakings on the basis laid down by the Council. Inevitably, the proposal has met so far with a very cool response—a result which will by no means distress the Council under their present circumstances. Compulsory powers can be sought next year; and, in the meantime, any growth in value is to be checked by upsetting the Companies' Bills. Those Bills also have the particular demerit of running counter to the Water Bill of the County Council, though, as a matter of fact, the latter measure stands little chance of passing in its present form. Concerning the Staines project, for which no Bill has yet been prepared, Mr. Walter Hunter writes to *The Times*, explaining that the total cost of the works would be £5,391,000. The estimate which has been cited as £10,000,000 is made up by capitalizing the pumping charges, in order to contrast the scheme with that of a supply from Wales—reckoned to cost £30,000,000. Some of the other points in Mr. Hunter's letter, to which the Chairman of the Water Committee (Mr. Bassett Hopkins) replied on Saturday, we may advert to later on.

We readily acknowledge that there is something calculated to attract the attention of engineers and geologists in Mr. William Haywood's account, which we publish this week, of the artesian well sunk at the instance of the City Commissioners of Sewers in Gravel Lane (or Stoney Lane, as the locality is termed by Dr. W. Sedgwick Saunders). But whatever may be the scientific character of the official record, our interest in the subject depends more especially on such relation as may exist between this particular well and the general question of the Metropolitan Water Supply. At the outset of the report, we are informed that the Commissioners of Sewers undertook the sinking of the well, owing to their attention having been called "to the excessive charges made for water supplied to the "citizens of London." The construction of this well, therefore, was entered upon in order to show that a cheaper supply of water could be obtained than that which was furnished by the New River Company. The Engineer's report gives the capital account or cost of the well, but not the working expenses, although there is a gas-engine to be attended to, involving a daily consumption

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Changes in the Engineer's Department of the Commission of Sewers.—At the meeting of the Commissioners of Sewers of the City of London last Tuesday, a recommendation of the Finance and Improvement Committee on the subject of the position of the Engineer (Mr. William Haywood, M.Inst.C.E.) came up for consideration. It was to the effect that he should be retained as Consulting Engineer, and relieved from continued attendance at the Guildhall and meetings of the Court and Committees, but that, in consideration of his services being at all times available when required, his present salary should be continued. The Committee also recommended that it should be referred back to the Committee to inquire as to the staff in the Engineer's office, and how the department would be affected by the proposed retention of Mr. Haywood as Consulting Engineer. The recommendations were adopted.

WATER AND SANITARY AFFAIRS.

THE recommendation of the Water Committee of the London County Council, that those members of that body who hold seats in Parliament should be requested to vote against the three Bills of the London Water Companies on the motion for the second reading, and to "take all possible steps" to ensure the rejection of those measures, was adopted last week, in the face of a vigorous remonstrance from a County Councillor who is himself a Member of Parliament. Mr. Boulnois, who thus spoke, was supported by Mr. Beachcroft; but, of course, their united arguments had no more practical effect than as constituting a protest against the selfish policy espoused by the majority. If the Council cannot get possession of the water supply on their own terms and conditions, they will do their utmost to prevent the Companies raising any capital to extend their works. The aggrandisement of the Council is the object to be kept in view, whatever risk the interests of the public may incur. We have warned the Council that they are not making things safe for themselves. If, through their opposition, any catastrophe befalls the water supply, London will not speedily forgive them. The Irish vote may aid them in Parliament; but it will not help them before the tribunal of public opinion. The schemes of the Southwark and Vauxhall Company and the East London Company, which are coming before Parliament, are founded on a real necessity besetting the water supply of the Metropolis; and the Money Bill of the West Middlesex Company has a similar warrant. Opposition on second reading is the miserable device of a party unable to meet the case on its merits. The evidence in support of the Bills may be irresistible; but precisely for this reason the Council are determined that it shall not be heard, if they can by any means accomplish that end. Parliament, if wise, will insist on knowing what it is called upon to reject; but our senators are not always wise, or the County Council would not expect to find the Legislature playing into its hands. As mentioned in our columns last week, and confirmed by the report which appears elsewhere, the Water Committee have sent a communication to the Companies, asking whether they would enter into negotiations for the sale of their undertakings on the basis laid down by the Council. Inevitably, the proposal has met so far with a very cool response—a result which will by no means distress the Council under their present circumstances. Compulsory powers can be sought next year; and, in the meantime, any growth in value is to be checked by upsetting the Companies' Bills. Those Bills also have the particular demerit of running counter to the Water Bill of the County Council, though, as a matter of fact, the latter measure stands little chance of passing in its present form. Concerning the Staines project, for which no Bill has yet been prepared, Mr. Walter Hunter writes to *The Times*, explaining that the total cost of the works would be £5,391,000. The estimate which has been cited as £10,000,000 is made up by capitalizing the pumping charges, in order to contrast the scheme with that of a supply from Wales—reckoned to cost £30,000,000. Some of the other points in Mr. Hunter's letter, to which the Chairman of the Water Committee (Mr. Bassett Hopkins) replied on Saturday, we may advert to later on.

We readily acknowledge that there is something calculated to attract the attention of engineers and geologists in Mr. William Haywood's account, which we publish this week, of the artesian well sunk at the instance of the City Commissioners of Sewers in Gravel Lane (or Stoney Lane, as the locality is termed by Dr. W. Sedgwick Saunders). But whatever may be the scientific character of the official record, our interest in the subject depends more especially on such relation as may exist between this particular well and the general question of the Metropolitan Water Supply. At the outset of the report, we are informed that the Commissioners of Sewers undertook the sinking of the well, owing to their attention having been called "to the excessive charges made for water supplied to the "citizens of London." The construction of this well, therefore, was entered upon in order to show that a cheaper supply of water could be obtained than that which was furnished by the New River Company. The Engineer's report gives the capital account or cost of the well, but not the working expenses, although there is a gas-engine to be attended to, involving a daily consumption

of gas, and there are also pumps to be kept in a state of efficiency. As the water has to be raised from a depth never less than 120 feet, and often considerably more, in addition to which it has to be forced up to the tanks on the roof of the artizans' dwellings in the neighbourhood of Stoney Lane, we may assume that the gas account is worth noting. The yield of the well, when tested by continuous pumping, is found to be about 70,000 gallons in 24 hours. At this rate, if we compare the capital expenditure at the outset with the annual yield from the well, we find the former to have a proportion of about 4s. 4d. per 1000 gallons, while the capital of the eight Metropolitan Water Companies averages about 4s. 6d. We are aware that the proportion ranges higher than this in the case of the New River Company; but an important fact remains to be considered. We are giving the utmost "yield" of the well, while we are only giving the "supply" furnished by the Companies. Mr. Haywood states that 3000 gallons per hour is "more than three times the quantity needed "to supply the artizans' dwellings." If so, the capital account of the City well rises to something like 12s. per 1000 gallons per annum on the supply—an amount which more than doubles the New River proportion. Seeing that a complete balance-sheet would bring in additional charges, the City well, however creditable as an engineering enterprise, looks very like a bad speculation; and even if the entire yield were dealt with, we greatly question whether any pecuniary advantage would appear, compared with a supply taken from the Company. We read of fire hydrants having been provided from "the Commissioners' "mains" in connection with the well. This sounds very grand. But the report also says that the fire hydrants on the mains of the New River Company "are available "in case of need." The Commissioners of Sewers may possibly remember that the New River Company furnish without charge the supply of water requisite for protecting the City against the ravages of fire. In respect to the statutory rights of the London Water Companies, which the County Council seek to conjure out of existence, some useful and significant statements by the City Solicitor are quoted in the course of the report. Of the reality of those rights, the civic authorities are very distinctly reminded; and they have found themselves bound to respect them.

Subways in Liverpool.—At a recent meeting of the Liverpool Engineering Society, Mr. J. Morgan, Assoc.M.Inst.C.E., Chief Surveyor of Roads to the Liverpool Corporation, read a paper on "Street Pavements," dealing exclusively with the impervious pavements laid under his supervision in the city since 1872. In the course of the paper, he dealt with the question of subways for water, gas, telegraph, and other mains; and the desirability of such provision in the streets was shown by the fact that, in 1892 and 1893, 45½ and 40½ miles respectively of trenches were cut for these purposes in carriageways and footways.

Steel v. Cast-Iron Pipes for Water Supply.—In the JOURNAL last week we mentioned that the Bradford Corporation had accepted the tender of Messrs. T. Piggott and Co., Limited, of Birmingham, for the supply of steel pipes needed in connection with their new water scheme. The pipes are to be of welded steel, 36 inches in diameter; and the total weight will be 1800 tons—the price amounting to £29,568. It is interesting to record, in connection with the foregoing facts, that this is the first time that welded steel pipes have been used in this country, in preference to those of cast iron, for a large water scheme; and that the price is not very much greater than it would have been for an equal length of cast-iron pipe.

Forms of Steam-Jets.—A French investigator (M. Parenty) has been studying the forms of steam-jets from various orifices, and has published his results in the *Comptes Rendus*. The diagrams accompanying the paper, in which regions of different pressures are shaded differently, exhibit some curious fluctuations, which, says *Nature*, may be described as a series of nodes and ventral segments proceeding outwards from the orifice. These fluctuations are due to the interference between the outgoing waves of steam pressure and those reflected back by the air. In the case of a convergent elliptical orifice of 13°, three nodes were found with pressures of 115, 165, and 138 centimetres respectively; that at the orifice being 285 centimetres. All the nodes occurred within 2 centimetres of the orifice. They were found by means of an air manometer provided with very finely-drawn glass tubes. It appears that the position and value of the nodes or condensations depend upon the difference of pressure between the boiler and the atmosphere, and the form of the orifice. At very high pressures, the jet assumes an approximately paraboloidal shape, such as would be assumed by a liquid jet falling upon a disc of the size of the orifice. A further conclusion reached by M. Parenty is that the highest attainable velocity of efflux is the limiting velocity of sound in the medium concerned.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 531.)

As might be expected, the past week, with the formidable array of holidays in its rear, has had its business lopped of a large share of its normal proportions; and the fine weather, while tending to induce an amount of firmness in markets susceptible of the influence of climatic conditions, has, on the other hand, had a disposition in favour of holiday-making. And yet, on the whole, business has not been so slack as might well have been the case. The upward tendency which was noted last week, has been pretty well maintained; and there is a fair show of semi-activity, although public enterprise is not yet fully revived. A few new undertakings have been offered during the week for the public acceptance; but, to say the least, not all of them are of such a character as one might desire to see in the van of advance. Pretty well all the principal departments have shown a good steady tendency. Consols, and other gilt-edged luxuries, are doing well; rails of almost all descriptions are firm; and, though the Foreign Market has not been uniformly steady, the general condition is fair. Things are more lively in the miscellaneous or "all-sorts" market, where beer and meat concerns are see-sawed up and down from day to day. Money has been in very good demand; and it is likely to continue in the same position at least until all the requirements for the settlement this week are satisfied. The Gas Market has displayed fully normal activity, especially in the heavier issues. Changes in quotation are not numerous; but, such as they are, they all are in the upward direction. In Gaslights, the "A" was steadily dealt in daily, with a slightly improving tendency; and several of the secured issues changed hands at better than average prices. South Metropolitans continue very firm; and the "B" improved its position on Monday by an advance of 2. Commercials were steady and unchanged. The Suburban and Provincial Companies were quite devoid of all feature. The Continental undertakings held their own firmly; Union especially commanding nice figures. Several Companies in South America displayed improvement. Buenos Ayres debentures rose 1½; San Paulo, ½; and Pará, ¼. The Water Companies have been rather stagnant, and prices are but little changed. Lambeth 10 per cents. fell 2 on Monday.

The daily operations during the few days on which the Stock Exchange was open, do not call for further detailed notice—actual movements being sufficiently recorded above.

ELECTRIC LIGHTING MEMORANDA.

The Board of Trade Regulations for Electrical Tramways—The Lighting of the Victoria Embankment—Tower and other Fancy Lighting—The Prudence of Maidstone.

THE Board of Trade have issued their regulations for electrical tramways, as mentioned in a paragraph in last week's JOURNAL, and therefore all who are interested in the subject are now able to appreciate the nature of the protection which the Department consider to be necessary "for preventing fusion or injurious electrolytic action of or on gas or water pipes or other metallic pipes, structures, or substances." In the fifth paragraph of the regulations it is provided that, in certain circumstances, an earth connection may be made "to a main for water supply of not less than 3 inches internal diameter, with the consent of the owner thereof and of the person supplying the water." Otherwise the electrical earth connections are not to be placed within 6 feet of any pipe. A test is described which an owner of pipes may require to be used with the view of ascertaining that the prescribed conditions are observed as regards his property. Stringent regulations are made with reference to the conduits in which lines may be laid, with the object, among others, of preventing electrical action between the wires and any pipe that may be within 6 feet of them. In the case of leakage of current, it is provided that this is to be tested for daily, before or after the hours of running, when the line is fully charged. If at any time the leakage is found to exceed half an ampère per mile of tramway, the leak must be localized and "removed" as soon as practicable; and the running of the cars must be stopped unless the leak is discovered and removed within 24 hours. Daily records of these tests are to be kept. The general idea of the regulations, as affecting pipes, seems to be that 6 feet of earth is a sufficient obstacle to any action between them and electric lines of the kind in question.

The fatuous proposal of the Highways Committee of the London County Council to spoil the Victoria Embankment by placing lamp-posts for arc lights along the line of the centre of the roadway about 50 yards apart, has been successfully quashed by the superior sense of the general body. But the fact of its having been recommended is a disquieting reminder of the risk that London runs of having its finest features ruined by a catch vote of the popular authorities who happen for the time being to have supervision over the buildings and thoroughfares of the Metropolis. The idea that "ornamental lamp-columns" would suffice to correct the wanton injury that would be done by breaking up the splendid sweep of quay-road which is one of the glories of the capital, is illustrative of the short-sightedness that so commonly characterizes committees of local

authorities. The Committee in this case could not rise to the perception of the fact that the lighting they proposed to arrange for in this manner is not wanted at all, even without consideration of the sacrifice of the unimpeded thoroughfare which it would entail. They were apparently overborne by the thought that it was necessary to get the roadway electrically lighted at any cost; but they seem to have overlooked the circumstance that, even if their suggestion were to be carried out, the trees bordering the footpaths would screen the latter from the light for six months in the year. Fortunately, it is easy not to light the Embankment with arc lamps; and so the question will be allowed to rest for awhile.

The vagaries of electricians in the matter of public lighting have been many; but the actual amount of progress in the art which the world owes to their initiative, is insignificant. The announcement which we recently noticed in an American newspaper that the last electric lighting tower on the continent was being taken down, served as a reminder of perhaps the most egregious piece of folly to which these clever gentlemen ever committed themselves and a confiding public. We were almost alone at the time in protesting against the crazy notion that the proper way to light the streets of a town consisted in hoisting arc lamps above the tiles; but it is long since our justification in this regard was complete. Tower lighting persists, in a modified form, for railway goods yards; but here, at any rate, the conditions are favourable to overhead lighting—all the objects in the field being of small elevation. Even so, however, the general effect is not pretty; the naked arc which is used from the motive of economy giving a ghastly aspect to the grimy, unreflective ground surface and the dingy trucks. We have said before, and repeat, that General Webber's lamps in the City are the most successful attempts to be seen anywhere to solve the problem of rendering arc lighting unobjectionable in the streets; but even so the result is not worth the cost.

The announcement that the Maidstone Local Board have decided to sell their Electric Lighting Order to a company, if they can find a purchaser, and the fact of this decision having received the emphatic support of the local press, are to be taken as signs that not every local authority is to be "had flying" by the electrical sportsmen who are engaged in stalking such game up and down the country. The trifling circumstance that the said Order expires in about four months' time may be interpreted in various ways as bearing upon this prudent resolve of the Maidstone burghers; but it at least testifies to the deliberation with which they have acted in the matter. The proceedings at the Local Board meeting which ended in the way recorded are illustrative of the manner in which public bodies are often egged on to embark in undertakings much better left alone, by enthusiasts who can only boast of that "little knowledge" which, being partial as well as small, is of the most dangerous kind. An alderman asked the ratepayers of a little place like Maidstone to involve themselves with electric lighting, because he had heard that the Bradford Corporation are producing electricity at less than 2d. per unit. Of course, this rash guardian of the interests of the people of Maidstone did not mention the fact that at Hove—not such a "far cry" as Bradford—the Directors of the local Electric Lighting Company who have spent £30,000 upon their undertaking, and are about to lay out £10,000 more, regard a profit balance of £1 2s. 8d. on the past year's working as "extremely satisfactory." Fortunately for Maidstone, the Local Board contains among its members some individuals who are able to winnow electricians' promises with a thoroughness not within the power of all gentlemen in municipal office; and consequently it is not surprising that the Board wisely decided to part with the Provisional Order to whoever is willing to take it at a price. We doubt if there will be any bidders; for at present it is a practical impossibility to get any capital together for a central station electric lighting venture. We take credit to ourselves for having helped to keep the Maidstone ratepayers from tying the millstone of an electric lighting undertaking round their necks, by persistently exhibiting in the light of day that "seamy side" of the business which the electricians (small blame to them) are so careful to keep turned away from the public eye; and one little town saved from trouble of this kind is ample return for all the pains taken in this regard.

The Assistant Managership at Bombay.—Mr. Stephen Newcombe Wellington, of the Norwich branch of the British Gaslight Company, has been appointed to fill the position of Assistant-Manager of the Bombay Gas Company.

Death of Mr. Alderman Brown, of Deal.—The death took place on Tuesday last of Mr. Alderman Brown, for many years Chairman of the Board of Directors of the Deal Gas and Water Company. The deceased, who was 92 years of age, was a Magistrate, and had been Mayor of Deal five times, besides holding other important public positions.

Death of Mr. Meysey-Thompson.—The death is announced of Mr. A. C. Meysey-Thompson, Q.C., a prominent member of the Parliamentary Bar. He had been in ailing health for the past two or three years, and had been compelled to spend the winter months abroad. He returned to England on the 17th inst., with the intention of resuming his practice; but he had a relapse, and died last Tuesday, in his 46th year.

THE GAS SUPPLY OF MANCHESTER.

The Gas Committee's Reply to their Critics.

As the Gas Committee of the Manchester Corporation have of late been one of the best-abused bodies in that city, it is perhaps only fair that they should be permitted a few words by way of reply. We have pleasure, therefore, in publishing some notes, forwarded by our Manchester Correspondent, of a conversation he has had with a prominent member of the Committee, whose opinions, so far as can be ascertained, are those of the Committee generally.

"No, we don't feel much cut up because of the vote in the Council and the letters in the newspapers," was the Committeeman's reply to our correspondent's opening question. "It is true that, in times gone by, the gas-works of the city may not have been managed with as much energy and enterprise as might have been wished, and there was perhaps some excuse for this. Although experience is teaching us that there was no ground for the idea, it was feared for many years that the introduction of the electric light might diminish the demand for gas; and one can hardly wonder, therefore, that some of our predecessors did not care to launch out into lavish expenditure. But since the present Committee got to work, there has been no lack of energy and vigilance. We complain that the present attack comes upon us just at the time when we are bending our backs to the work of making good any deficiencies there may be in the works. Already we have spent, with satisfactory results, about £125,000, mainly in providing increased holder and purifying plant; and we shall spend about as much again before we have done."

"So you think your critics in the Council and in the Press have not made out any real case against you?" queried our correspondent.

"Emphatically so," was the prompt reply. "We say that the figures we put forward in reply to those of Councillor Southern cannot be controverted; and they show that we occupy an excellent position among the gas undertakings of the country. We proved that he had misquoted certain figures, and that in another case he had struck an average in a ludicrously incorrect way. So that we think we shall dispense in the meantime with the Commission which the JOURNAL OF GAS LIGHTING proposes, although what kind of Commission the Editor means is not quite clear. We say that the Gas Committee is composed of twenty-five or twenty-six men who have in their own businesses shown the possession of business capacity, and that so far they have done nothing to forfeit the confidence reposed in them by their constituents."

"And they do not intend adopting the suggestion that a Chief Engineer should be appointed to supervise the works generally?"

"The idea of Mr. Southern, and apparently also of the JOURNAL OF GAS LIGHTING, is that we should appoint a man at a salary of £1000 a year, or perhaps more; and that we are in no mind to do. The thing has been tried here before. We had a Chief Engineer such as Mr. Southern wishes; and he was so clever that nothing could be done except what he said should be done. He was practically Chief Engineer, Committee, and everything else. The result was division and disagreement in the Committee; and the arrangement had to come to an end. As you may imagine, we do not feel inclined to renew it."

"Is it proposed to do nothing more than is at present done in the way of securing unity in the management of the different stations?"

"That, we think, is to a considerable extent already accomplished. Our Manager at the Rochdale Road works, Mr. G. E. Stevenson—a thoroughly competent man, who was selected from among seventy applicants—was engaged on the understanding that, in addition to acting as Station Manager, he should give us such advice and assistance as we might require with regard to any of the other stations. In order to leave him free for such work, we have provided him with an efficient assistant, who can take charge at Rochdale Road in his absence. Well, so far, we have reason to be entirely satisfied with Mr. Stevenson's work. With regard to the great gasholder and tank at Bradford Road, for example, these were designed by him; and what does the eminent Engineer, Mr. Corbet Woodall, say about them? 'It is a pleasure to me to say that I regard the design as generally excellent, and that such suggestions as I have to make are upon matters of detail, not of principle. I have rarely seen a set of drawings more complete, or which bore evidence of more thoughtful consideration of all the questions which arise in the design of so important a structure.' Is that an opinion which indicates that we are not receiving such engineering advice as is conducive to the prosperity of the undertaking? And we have, in addition to Mr. Stevenson, a competent gas maker at each station. At the Bradford Road station, we are thinking of appointing a trained assistant to the present Manager, so as to keep pace with the development of the works there."

"And are the Gas Committee showing any activity in the way of trying to popularize the use of gas, or are they simply going on in the sleepy old way?"

"No; we are not asleep by any means. We are doing what can be done in the way of introducing automatic prepayment meters. Up till now, we have held back with regard to these, because of the difficulties in the way of working them satisfactorily; but now the difficulties appear to have been overcome. The contract has just been let for a stove show-room, which is to cost from £3000 to £3500; and when the building is ready, we propose to announce various ideas for popularizing the use of gas for other than illuminating purposes." Then, abruptly changing the subject, the member of the Gas Committee proceeded: "There has been a good deal said in the papers about the cost of collecting accounts. It is said to be monstrous that each collector should get £300 a year. Well, the rate at which collectors are now appointed is only £140; and they go up to £200, which is now the maximum so far as new appointments are concerned. There has, of course, been no reduction of salaries in the case of men already receiving £300 a year, some of whom have been thirty and forty years in the service. The result of our action in relation to salaries for new appointments is that, whereas in 1883 the cost of collection was £1 13s. per cent. on the revenue, in 1886 it had come down to £1 12s. 9d.; in 1888, to £1 10s. 7d.; in 1891, to £1 7s.; and in 1893, to £1 4s. 2d. If the 1883 percentage on the revenue had been maintained, the cost of collection in 1893 would have been £9166 instead of £6708. This shows that the Committee are alive to considerations of economy."

Just as our representative was closing the note-book in which were enshrined the foregoing facts and opinions, Mr. Williams, the senior Chemist to the Gas Committee (who had dropped in), contributed his quota to the defence of the Gas Committee thus: "With regard to what is being said about sulphur in the gas, there is a good deal of sentiment in the matter, as Dr. Schunck suggested in his remarks at the meeting of the Manchester Section of the Society of Chemical Industry. It is generally not the bad gas, but the lack of ventilation at the ceilings of rooms, that injures the bindings of books, and does damage to the leaves in the way complained of. In the absence of such ventilation, excessive heat is quite as injurious as gas. But we are doing all we can to get as much as possible of the sulphur out of our gas. A considerable increase is being made in the purifying plant at each works. We are at present engaged in an experiment in which we are attacking the sulphur with caustic ammoniacal liquor."

"We quite agree," added the member of the Committee, "that there is more sulphur in the gas than there ought to be, and that it is desirable the quantity should be reduced."

THE INDUSTRIAL POSITION.

During the past few weeks there has been a good deal of "movement," in a quiet way, in two departments of social activity with which the gas industry has close relations, though in different directions. Municipalism has been brought to the front by the meetings of the Association of Municipal Corporations; and what is comprehensively called the Labour Question has also maintained its interest by producing several noticeable developments. The long-expected report of the Labour Commission cannot be much longer delayed. It is understood, indeed, that the Duke of Devonshire would have been prepared ere now to put the world in possession of the deliberate opinions of himself and the majority of his colleagues upon the matters submitted to the Commission, but for the action of a small knot of members identified with the Social Democratic element, who are accused by rumour of having refrained from joining the rest in their deliberations—meanwhile busying themselves with the concoction of a "minority report." If this rumour, which has been repeated in several newspapers likely to be well informed with regard to the inner workings of the Commission, should prove to be well founded, the minority who have committed themselves to this line of action will merely proclaim thereby the not-surprising result of their having preserved the prejudices with which they entered upon their labours. This is at once the difficulty of, and one of the prime objections to, the investigation of controversial subjects by Royal Commission. If impartial commissioners only are appointed to conduct the inquiry, it is said of them that they have no interest in the matters brought before them; if it is a commission of partisans, the chances are in favour of prejudice vitiating the conclusions arrived at. So that if a unanimous report is the result of the inquiry, this is only obtained at the sacrifice of all point; or such a conflict of judgment is revealed by the promulgation of incompatible majority and minority reports as to leave the matter at issue where it was before.

Meanwhile, the Commission has continued, through the comprehensive activity of the Secretarial Department, to bear valuable fruit in the form of Foreign Reports. The latter of these Blue-Books, relating to conditions of industrial employment in Switzerland and Italy, has no direct bearing upon the class interests with which these columns are identified. Indirectly, however, this carefully collected and edited information is of great importance to employers of labour wherever wages are high, as revealing the conditions and localities where labour is cheap. Many industries are of a cosmopolitan character, and consequently might be carried on wherever circumstances are most favourable. The remarkable tendency of Italian labourers to man certain industries, such as the asphalte, chemical, and similar trades, and their aptitude for stoking work, lends special interest to Mr. Geoffrey Drage's statement as to their original condition when at home. In the United States, at any rate, a large proportion of the gas stokers are Italians.

Not many days ago, an interesting conference between employers of labour and representatives of Trades Unions was held in the hall of the Royal Statistical Society, in Adelphi Terrace, under the presidency of Mr. R. A. Hadfield, of Sheffield, which calls for some comment at our hands. We are not informed as to how the gathering was promoted; but it resulted, after some private negotiations, in a public meeting for the purpose of advocating the establishment of an "Industrial Union of Employers and Employed," with a view to bringing about a better understanding between Capital and Labour. The idea does not strike one as particularly novel. At the first blush, it might be thought that the topic has been pretty well talked over on many platforms; but there appears to be something special about these proceedings, inasmuch as they have received the approval and enlisted the active co-operation of such men as the Chairman, Mr. William Bushill, of Coventry, Mr. Charles Booth, Mr. David Dale, and Mr. John Wilson, M.P., of Durham.

It must be admitted that the time is well chosen for making an attempt to secure the recognition from both parties in industry of the existence of common ground upon which both may stand. There are no great trade disputes in progress, and, barring political preoccupations, there is no good reason why representative employers and employed should not meet face to face for the purpose of arriving at a clear understanding of their respective policies. Mr. Hadfield, in opening the meeting on the 16th inst., remarked that the foremost reason for holding it was the fact of there being "no place or organization where employers and employed can meet together on common ground for friendly discussion." And he proceeded to argue for such a mutual convenience on the broad ground that these industrial questions should be treated purely from the industrial and economical standpoint. He had nothing to say against Trade Unions; declaring, on the contrary, that "his own experience of those concerned in handling organizations for the workers had been excessively favourable." He pointed out that reasonable men must agree to there being always two sides to every question. "It did not require much political economy to see that, other things being equal, trade must naturally gravitate to those places where the cost of production is at its lowest point." This is as much as to say that harsh, inconsiderate treatment of capital by labour must have the effect of driving it away. Mr. Hadfield further conceded to the Trade Union leaders of whom he was speaking the ability to realize the difficulties of modern commercial enterprise; and he claimed that all parties would welcome any means of amicably adjusting labour relations on progressive lines. "There might," he said, "be some labour representatives who think that capital, or interest on capital, as such, should be extinguished. His own opinion was that this was for some generations impossible; but the difficulty might be met by giving a fairer share of the returns on capital than in the past to the workers, by reducing the hours of labour, profit-sharing, or other means of this kind." These are words of wisdom; and hearing them is good at a time when the ravings of irreconcileable Socialists, posing as the only friends of the working classes, had almost driven one to think that English common sense as well as the native genius for compromise have vanished from the land.

There is no reason in the world, nor ever has been, why organizations of working men should not fulfil their mission co-existently with the preservation of a fair understanding between employers and employed as to the proper shares of capital, brains, and labour in the gains of industry. It has unhappily been the curse of the Trades Unions to be controlled in very many instances by narrow-minded, short-sighted, headstrong chiefs, who, even when they have had no selfish interest to serve, have committed the forces at their command to disastrous policies. In many of the internal dissensions that so often disturb the shipbuilding centres, the trouble is due to the selfishness of one Union pitted against another; and often, as at Hull, it arises because the Unions put men in power who are incapable of perceiving the conditions under which trade can alone be carried on. It is hardly necessary to cite such instances as the miserable Manchester gas and the Silvertown strikes, in which John Burns cut such a sorry figure, or the Cardiff and Southampton performances of the honourable member for Middlesbrough, as instances of stupidity wrought in the name of Trade Unionism.

We are quite willing, however, to let bygones be bygones; and to pass a generous measure of amnesty to such of the Trade Union leaders as may be desirous of turning over a new leaf, and reconsidering their position in regard to employers, for the reasons dwelt upon by Mr. Hadfield. We gladly give prominence to this gentleman's testimony to the statesmanship exhibited by Mr. William Thorne, in his recent conduct of the affairs of the Gas Workers' Union, and in the discredit poured upon the "strike method" in his last report upon the working of this Union. Indeed, the way in which Mr. Thorne has kept his head and his place throughout a long and trying period, is deserving of admiration; and it fully

justifies the high opinion we have always held and expressed of the single-mindedness and sterling honesty of the man. He has, of course, made many mistakes, and has not been able to keep clear of doubtful companions; but, for all that, William Thorne is a man his opponents respect, and a representative of an order of men of whom his country may well be proud.

At the meeting in question, Mr. Bushill, well known as a pioneer of and fervent believer in profit-sharing, read a paper explaining the lines upon which the Industrial Union of Employers and Employed may be effected. No particular prominence was given to profit-sharing in this scheme, which rests upon the wide principles of "promoting harmony between employers and employed by affording opportunities for each side to obtain a better understanding of the other's aims and difficulties, and to realize in large measure their common interests, and discussing means by which, without detriment to business, the conditions of labour and the opportunities of workmen may be improved." A committee was appointed to carry out the objects of the conference, which may be all the more successful by reason of its quiet inception and the absence of all parade from its transactions.

The time is ripe for some action of the kind; for the actual and prospective adoption in many larger factories of the 48-hour week marks an era in British industrial history which will in all probability have results of the greatest moment. It is not at all likely, however, that these results will be such as the enthusiastic "Eight Hours Men," as they call themselves—such as Mr. Tom Mann and his fellows—expected or wished for when they started their agitation upon this head. They had the idea that the universal and compulsory limitation of work to eight hours out of the twenty-four would have the effect of absorbing more workers for the production of the same bulk of commodities—in other words, that it would reduce the number of the unemployed. They said as much, over and over again; proclaiming at the same time that if the eight-hour day failed of this effect, they would then go for six hours, or four if necessary, until not a man should be unemployed in the land. This ideal was absurd, of course, if only because, for its fulfilment, the country would need to be closed to immigration of workers from less favoured regions. But there is no disputing the fact that it existed. What has happened so far in connection with the tentative adoption of the 48-hour week, which, by the way, has been brought in, not by the constraining of a "universal strike," such as John Burns used to talk about before he became a serious-minded legislator, but as an experiment of employers. Briefly stated, the immediate effect has been a general smartening-up all round. Eight-hour men will have to work harder while they are at it; the "Union stroke" will be discarded; overtime will be discouraged; men on piece-work will have to be nimble indeed if they are not to take less money at the end of the week; the better men will come to the front—and the spouters, the malingerers, the politicians, the men who talk big on Sundays and lose a quarter on Mondays as a regular thing, will themselves be driven into the ranks of the unemployed. Only such employers as have the most modern plant, the best machinery, and whose works are favourably situated, will have the courage to try the 48-hour week; and only the best men will be able to stand it. As our contemporary the *Engineer* well remarks upon this subject, "the weakly, the men past middle life, and the more or less incompetent, will certainly gain nothing, and will probably suffer a good deal from the general adoption of a shorter day; and it does not appear to be likely that it will give additional employment to one per cent. of the workmen."

This is a good illustration of what comes from meddling with powerful influences which are little understood. We are not thinking now of the gas stokers, who have not in all cases found the eight-hour shift an unmixed advantage. An eight-hour shift, as we have often had occasion for arguing, differs essentially from a eight-hour day. The number of watches into which a continuous task may be conveniently divided is a question depending for its answer upon different considerations from anything that goes to control the duration of factory labour. The latter is a question wholly of getting a definite output for a minimum of cost; and it is quite possible for this to be the result of eight rather than of nine hours' work, from precisely the same cause that makes one man better worth six shillings than another man is worth five shillings a day. In all these matters, as Mr. Hadfield remarks, employers will have their say; and the sooner the Labour leaders realize this truth, the better it will be for those whom they represent. It is possible to hope that the lesson taught by the result, so far as it can be known, of the 48-hour week will help to bring employers and employed together upon some such common ground as that laid out by Mr. Bushill's scheme. When the intelligent workman realizes that, though the Trade Union leader may become a Member of Parliament, the employer has still to be reckoned with, the executives of Trade Unions will be less heroic and more reasonable. We wish all possible success to the Industrial Union of Employers and Employed.

Society of Chemical Industry.—At the meeting of the London Section of this Society, at Burlington House, on the 2nd prox., Mr. W. C. Young, F.I.C., F.C.S., will read a paper on "The Natural Diminution of the Dissolved Organic Matter in the Water of Rivers."

NOTES.

Solidified Petroleum Fuel.

A considerable amount of discussion has taken place among mechanical engineers respecting the advantage to be gained by solidifying petroleum and other liquid combustibles before using them as fuel. Some critics have gone so far as to pour ridicule upon the idea of solidification, upon the ground that whatever material is added to the liquid fuel for this purpose must detract from its calorific value, and be a useless addition to the weight to be carried about. But, on the other hand, these critics overlook the fact that either steam or air blast is a necessary accompaniment to the proper combustion of liquid fuel, which is tantamount to an increase of the cost of burning it as compared with a solid fuel. Signor Maestracci, of the Italian Navy, has devoted much attention to the solidification of petroleum for fuel; and he has succeeded in making it into briquettes of similar form and size to the small-coal briquettes extensively used in France and Germany. The mixture is made in the proportions of 1¾ pints of petroleum, 10 per cent. of rosin, 5¼ oz. of powdered soap, and 11¼ oz. of caustic soda. The mixture is heated and stirred at the same time; and when it begins to set, it is poured off into moulds—more caustic soda being added, if necessary, to complete the solidification. Wood sawdust may be mixed with the liquids to cheapen and harden the briquettes. In trials made at Marseilles upon several tug-boats, the petroleum briquettes proved three times as powerful heat generators as coal briquettes of the same size. They must, however, be much more costly; and their use involves the sacrifice of that facility of firing without labour which is the chief recommendation of the oil-fuel injector systems.

An Unobserved Effect of Light.

Some remarkable effects of light have been observed by Mr. F. Elfving, and are described by him in the journal of a Finnish Philosophical Society. It is stated that if platinum or burnished steel are exposed for some time to direct sunlight, the sun creates in them a condition which, though otherwise imperceptible, manifests itself by the fact that the body has a powerful attraction for the hyphœ of a particular plant, *Phycomyces nitens*, well known to every plant physiologist. This power appears on the illuminated as well as on the opposite side of the body, and lasts for some hours. The phenomenon is somewhat mysterious, but is not altogether without analogy. It is a well-known fact that a number of non-luminous bodies, after being exposed to illumination, emit light in a manner commonly described as phosphorescence. Metals do not belong to the phosphorescing bodies; but in the case in point a kind of phosphorescence seems to occur, which is not visible to our eyes, yet takes effect upon the plant structure. The phenomenon might be designated dark phosphorescence, and the possibility of it was foreseen by E. Becquerel. The effect was produced by exposure to direct sunlight only, not to cloud light; and that it was due to light and not to heat is proved by check experiments, in which no similar result was produced by steel and platinum plates heated for hours to the same temperature. The ultra-violet rays of the sun have no particular share in causing the phenomenon, which is interesting as showing that mere exposure to light in some way alters the condition of certain metals without showing any sign to the eye.

Photometrical Suggestions.

There was recently read at a Students' Meeting of the Institution of Electrical Engineers a paper by Messrs. J. M. Barr and C. E. S. Phillips on the "Brightness of Light." The authors described a number of methods that have been tried with the object of making photometry more reliable by eliminating the human retina as the means of judging equalities of illumination. These devices have all failed, because the visual sense of light is apparently arbitrary, and has no relation to either actinic power or luminous intensity. The authors nevertheless suggest a chemical photometer depending for its indications upon the action of light upon carbonyl chloride. This compound is formed from a mixture of carbon monoxide and chlorine upon exposure to white light; and the mixture changes in volume from one to half when all combination is completed. For the measurement of high candle powers, it is proposed to employ a cylinder of the above mixtures exposed to the lamp and connected to a simple manometer tube, arranged to indicate in a magnified way the changes of pressure in the cylinder. Arrangements would be made for compensating for the heat effects and for the regulation of the gas pressure. The authors also propose a fresh attempt to use selenium grids in such a way as to give accurate results independently of any of the variations to which they are so liable. This might be done by recording the change of resistance, which is greater the brighter the light, without constancy or proportionality. The method is explained in the paper; but the use of selenium in photometry is hardly a practical idea.

Mr. A. Rigg on Ventilation.

Writing in the *Engineer* on the subject of the ventilation of rooms, Mr. Arthur Rigg remarks that the problem is not so insoluble as it is made to appear by common complaint. He poses the facts that hot air ascends and cold air descends by virtue of their different specific gravities, seeing that air dilates $\frac{1}{491}$ part of its volume for every additional degree Fahrenheit. It is argued, however, that it is too hasty a conclusion from

these premises that all exits for contaminated air should be at the top of a room, and that all fresh air should enter from below, which is the idea pervading most systems of ventilation of the so-called "natural" order. Mr. Rigg goes on to state that, despite the law of diffusion of gases, a surplus of the carbonic acid produced in crowded rooms finds its way to the floor. For this reason, General Morin and certain Glasgow professors have recommended that all fresh air should be admitted at the top of rooms, and that the foul air should go downwards through exits in the floor. Assuming that all is still and quiet in an occupied room, Mr. Rigg states that any carbonic acid that may have been entangled and drawn up by gas-jets will descend and cause the lower strata to be most impure, while the upper strata are hottest. Hence the one should be removed while the other needs but to be cooled. Mr. Rigby favours the "plenum" principle of ventilation under pressure by mechanical agency, involving the forcing of liberal quantities of fresh air into the upper regions of public buildings and inhabited rooms, leaving it to escape, when fouled, through gratings in the floors. In this way the abolition of draughts might be effected; but Mr. Rigg does not pause to inquire whether or not the principle, which is anything but new or untried, has drawbacks of its own.

The Determination of Cyanogen in Spent Purifying Materials.

The method devised by Moldenhauer and Leybold for the determination of cyanogen in spent oxide, has recently been discredited by a writer in the *Zeitschrift für Analytische Chemie*. The method consists in treating the powdered material with alkali; thereby converting the iron ferrocyanide into sodium ferrocyanide. A portion of the solution is evaporated to dryness with sulphuric acid; the residual iron salts are then brought into solution in sulphuric acid, reduced with zinc, and titrated with standard solution of permanganate. The objection raised to the method is that the large quantity of organic matter always present in the material brings iron that does not exist as ferrocyanide also into solution, and therefore the amount of cyanogen found is greater than that actually present. Dr. W. Leybold now writes to the above-mentioned journal to point out that the oxide contains from 33 to 45 per cent. of sulphur; and as this is treated with soda-lye at from 50° to 60° C., sodium sulphide is formed as well as sodium ferrocyanide and sulphocyanate. But it is impossible for iron salts other than ferrocyanide compounds to remain in solution with sodium sulphide. The objection to the method was raised in the first instance by Knublauch in 1889, and perpetuated by Drehtschmidt in 1892; but the latter a short time later retracted his statements against it. Drehtschmidt published the results of an examination of oxide by his own method and by that in question, and found them to agree well together. For Moldenhauer and Leybold's method, it may be mentioned that it was selected by the Berlin Chemical Society, after discussion, as that by which disputed cases should be decided.

The Removal of Iron Carbonyl from Water Gas.—We notice that Herr H. Strache, of Vienna, of whose paper on "Water Gas" we gave an abstract translation last week (p. 527) has patented in Germany methods for the removal of the iron compound which causes the troublesome deposition of iron oxide on the mantles of incandescent burners consuming water gas. He mentions in the specification the method of washing the gas with acid described in his paper, and also the decomposition of the iron carbonyl by passing the gas through red-hot tubes—a plan he considered to be impracticable at the time of writing his paper. By the first process, the iron carbonyl is converted into a soluble iron salt by the acid; by the second, the iron is deposited in the heated tubes.

Cast v. Wrought Iron.—The substitution of malleable castings for wrought ironwork in many of the industries of South Staffordshire is becoming, says *Industries and Iron*, very pronounced, with the result that the ironfoundry trade is just now almost the only one in the district which displays vitality and growth. Within the last few years, the production of malleable iron castings has undergone remarkable development. Stimulated by the rivalry of America, the local ironfounders have not only improved the quality and fineness of their castings, but have also cheapened the cost. It is now claimed that for many purposes in connection with the hardware industries of the Black Country, castings produced from soft Scotch pigs are equal to forged wrought iron, while the cost is considerably less.

A Coal Mine in Tonquin.—According to a statement recently made in *The Times*, the French have discovered, and are now actively working, a coal mine in Tonquin, which promises to produce excellent coal in considerable quantities. The mine is situated about eight miles from the port Hongay, in the bay D'Along; and a railway has been laid down for the whole of that distance. The length of the seam is given as 16 miles; and it is nearly 200 feet thick. The supply is, therefore, practically inexhaustible. At present about 500 tons a day are extracted by the simple process of quarrying; the mass of coal having only a very thin layer of soil on the top. The miners are exclusively Annamites, of whom about 200 are employed; but the higher officials are all Frenchmen, though the capital of the Company is chiefly held by English merchants at Hong Kong.

COMMUNICATED ARTICLE.

THE DEVELOPMENT OF THE GASHOLDER.

By A. M'I. Cleland.

An inquiry into the development of gasholders must not be directed merely to a consideration of their increase in size. Their various forms, the materials used, and the principles involved in their construction, from the earliest days of gas lighting to the present time, must be successively passed under review. We must carry such an inquiry much farther back than the time of Winsor; the apparatus he used for storing gas in his lectures at the Lyceum Theatre in January, 1804, and which is depicted in Parkes's "Chemical Catechism" (published in 1810), was comparatively antiquated, even in his time. The prototype of the present-day mammoth gasholder is to be found among surroundings differing as widely from those of a modern gas-works as the most fertile imagination can possibly conceive, and was invented almost simultaneously with the earliest inquiries into the nature of gaseous bodies; the experimentalists who first investigated the phenomena of gases discovering at a very early stage of their researches that some more convenient method of collecting gas in volume was required than by means of the old-fashioned bladders.

When Dr. Joseph Priestley—theologian, philologist, author, and scientist—removed to Leeds in 1767, and began to inquire into the nature and property of the "fixed air" evolved from the vats of his neighbour the Millhill brewer, his versatile genius quickly devised a rude piece of apparatus, out of a common tub and a bit of wood, with which the better to enable him to collect the gas. Subsequently the tub took the form of the well-known pneumatic trough and bell jar, and physicists at once saw that here was exactly the apparatus which they required; for in it they possessed ready means of collecting, storing, measuring, and drawing from a comparatively large volume of gas which should at all times be free from contact with the atmosphere, and could be kept apart for any reasonable period.

In the laboratories of the founders of modern chemistry, therefore, the progenitor of the modern gasholder is to be discovered; and when Winsor went about lecturing, he naturally enough used Priestley's arrangement of bell jar and trough as modified by the latter's Parisian friend, the gifted but unfortunate Lavoisier, about the year 1782. For the "hydrostatic bellows" of the latter was neither more nor less than a metal "jar" suspended by pulleys in a metal "trough" containing water, and provided with a pipe for the ingress and egress of the gas, or, in other words, what would now be considered a tank and gasholder reduced to lecture size. Of this "gazometer," as Lavoisier calls it, he was evidently justly proud, though he admits it was expensive; and in his "Elements of Chemistry," translated by Robert Kerr in 1793, he devotes an entire section of eleven pages and the whole of plate No. 8 to a detailed description of the apparatus. In this plate, besides showing the balanced beam on its pillar and the bell and tank of his "gazometer," he also illustrates, and describes in the text, a very modern-looking syphon-gauge, and an ingenious device for maintaining uniform pressure as the bell descended—the forerunner of the curved compensator of the present-day test-holder.

It is a matter of curious conjecture to speculate as to what would have been the probable effect on the progress of gas manufacture had Lavoisier never devised his hydrostatic bellows. At a very early stage, the necessity for some reservoir or store to be used in conjunction with the new process was recognized, but not always freely admitted. This is apparent from the evidence of one of the witnesses in favour of the first Gas Bill ever promoted in Parliament (in the year 1809), who recommended that no "reservoir" should be used. This he contended would remove all danger. The gas was to be delivered direct from retort to burner! However, the master-mind of William Murdoch had already condemned such a recommendation as impracticable, as, in his paper presented to the Royal Society in 1808, he lays special stress upon the fact that the gas "is conveyed by iron pipes into large reservoirs, or gasometers."

But although gasholders were thus early recognized as necessary adjuncts to the plant of a gas-works, it was some years before they were constructed on anything like rational principles. The gas companies first in the field had to go through a period of rough experience, during which almost every portion of apparatus had to be modified over and over again. With regard to the gasholders, it is curious to observe that the first engineering difficulties were connected with the tanks containing them rather than with the holders themselves. Wooden tanks were liable to burst, cast-iron tanks were expensive in construction, and brick or stone tanks were difficult to keep tight; and inventors were not wanting who devised other and improved forms of holders, which should work either without tanks at all or in tanks the capacity of which should bear a very small ratio to the size of holder.

And so about the year 1818, Samuel Clegg produced his "rotary" holder, and later on his "collapsing" holder,* in the fond hope that he would thus be able to avoid building deep tanks; Caslon† suggested the use of oiled silk; while Nicholson

* Patent No. 4283 of 1818. † Patent No. 4790 of 1823.

and Coles* show, in the elaborate series of drawings which accompanyies their specification, various ingenious methods of using a moveable diaphragm. But the development of the gasholder was fated to proceed in one direction only. The collapsing holder was soon abandoned; the rotary holder was found, after a little modification, to be far more useful as a "gasometer" than a gasholder—containing as it did some of the essential principles of the modern wet meter; the rectangular form of "bell" in its rectangular tank gave place to the cylindrical form; and in 1819 Peckston writes, in the first edition of his "Philosophical and Practical Treatise on Gas Light," when treating of the gasholder in Chapter XIII., that "it is a cylinder, the diameter being from 33 to 40 feet, and the height from 18 to 23 feet." This he recommends as the size most suitable for large works.

Prior to this date, however, a great improvement had taken place in the method of constructing the holder. There was a vast difference between the holder described by Peckston and those built seven or eight years previously. When we remember that the first engineers to the "London and Westminster Gas Light and Coke Company" (subsequently known as the Chartered, and now The Gaslight and Coke Company) were a chemist and a physician, neither of whom was overburdened with education in either engineering or mechanics, it is not surprising that the holders they devised should have been somewhat wanting in rational design. Owing, perhaps, to lack of knowledge of the laws of atmospheric pressure, these early engineers constructed gasholders remarkable for little save their enormous strength and weight. This excess of weight had to be overcome by an immense counterbalance—"thus," remarks Peckston, "removing one evil by introducing another; but," he quaintly and philosophically adds, "such will ever be the case when we commence upon wrong principles."

The credit of the earliest improvements in the bell of the holder (the guide-framing was not seriously considered till many years later) is undoubtedly due to the genius of John Malam. When he brought his creative faculties to bear, among other subjects with which his name is closely associated, upon the proper design that should be given to gasholder bells, he at once put his finger on the weak spots in the earlier structures of this class; for although he attempted to supersede the balance-weight by means of an air-float, and guided his holder by a central column—both methods now almost entirely obsolete—he was the first to show that the bell of the holder could be very materially reduced in weight and strength, and yet be perfectly safe. The bell, as it left the hands of Malam, may be considered to have started on lines of development which have never been deserted, although occasionally attempts have been made to modify both tank and bell. Even so late as 1849, Knapton† proposed to avoid the use of tanks by building the bell with a bottom, which was to be supported on piers reaching half-way up the inside of the bell. The lower half of the side sheets was to be formed of leather, "or other suitable material;" and as the bell descended, the bottom, slightly less in diameter than the crown, disappeared—the holder resting on the ground when it was empty. Further letters patent were taken out in 1857‡ for a modification of this arrangement. However, Malam's air-vessels were discarded—the central column was found to be inapplicable to large holders; but his bell remained, and its thin sheets, top and bottom angle-iron curbs, and light tie-rods, are all to be found in the holders of to-day.

It will be interesting to refer here to a curious attempt made in 1880 to revive the "central column" system of building gasholders. In that year, Mr. G. Barker, of Birmingham, read a paper before the British Association of Gas Managers, entitled "The Construction of Gasholders,"§ in which, among other recommendations, he strongly advocated the guiding of gasholders by a central column, as set out in the specification of his patent in 1879,‖ instead of by outside framing. The guide-framing of holders will be considered later. Here it is only necessary to notice that, while the discussion which followed the above paper was almost entirely condemnatory of Mr. Barker's suggestions, so far as they related to the central column holder, it elicited the fact that holders of this class had been built in London so late as 1830, of the respectable size of 40 feet in diameter and 20 feet deep; and, further, that a similar holder was then in use in St. Petersburg, and had been working satisfactorily for twenty years. This holder (constructed by Messrs. R. Laidlaw and Sons, of Glasgow), an interesting account of which appeared in the *North British Daily Mail* in the beginning of April, 1864,¶ was enclosed in a building—the central pillar serving the double purpose of guiding the bell and supporting the roof. The holder was in two lifts, 130 feet in diameter and 50 feet high, and of 653,000 cubic feet capacity. The central column was 72 feet high and 8 feet in diameter, and contained a spiral staircase to give access to the crown of the holder or the roof of the building; the latter being 154 feet in diameter.

One of the greatest difficulties the earlier gas engineers had to contend with, was the inequality in the pressure of the gas as the holder ascended or descended. Owing to the absence of any reliable meter, consumers paid for their gas according to the number of jets used. But the irregular pressure at the works (the station governor not being yet invented) proved a cause of serious loss to the companies supplying the light; and numerous were the devices patented to enable the holder to maintain a uniform pressure at any height. These, however, received but little patronage, as the growth of the gasholder, and the subsequent introduction of the station governor and consumer's meter, enabled the companies to sell their gas by measurement at a fairly uniform pressure. Malam's air-vessel has already been mentioned. He attached it to the sleeve which passed over the central guiding column. Perks, the first Engineer to the City Company, proposed* to affix a vessel inside the bottom curb, increasing or decreasing the pressure by admission of water or air. Outhett† had two air-vessels—one hermetically sealed to impart buoyancy, the other open at the bottom. As the bell descended, the air in the open-ended vessel was compressed, and acted as a compensator. The beautiful device of Stratton‡ is worthy of notice as the first attempt to construct a gasholder in a tank of but half the depth of the bell. Stratton's arrangement is illustrated in Vol. II. of "King's Treatise on Coal Gas," and is said to have given uniform pressure at all heights. It is interesting to note here the device§ introduced so recently as 1892 by Messrs. H. Balfour and Co., of Leven, Fife, and adopted at the Aberdeen Gas-Works,‖ in which the pressure of gas in the holder is increased or decreased by taking from, or adding to, the contents of a water-trough surrounding the outside of the holder, and suspended from it by chains passing over the guide-framing.

Various other patents connected with the construction of gasholders, were taken out in these early days. Among them we find the curious arrangement advocated by Holdsworthy,¶ who in 1817 suggested that an annular tank should be built for the holder to work in, but that the rest of the tank should also be excavated, and filled with water. After his holder had reached its full height, he would have lowered the water in the inner tank till the holder landed on the bottom of the annulus. The holder was then to be raised again, and so nearly double the storeage would be obtained.

Dealing with the development of the gasholder in chronological order, the next point to be noticed is the introduction of the telescopic holder and the hydraulic cup or water-lute. Here a difficulty is at once met with when endeavouring to fix an exact date to this invention. In the edition of Peckston's "Treatise" before mentioned, there is not the slightest reference to the telescopic holder, excluding, of course, Stratton's device. Clegg, in his third edition, published in 1859, states that telescopic holders were invented twenty years before they were brought into general use, and that they were first employed in 1834 at the Vauxhall Gas-Works. This would lead one to suppose that the telescopic holder was invented in Peckston's time, but had not been adopted at any works with which he was acquainted. Another scarcely known work states that "telescopic holders were invented and in use about 1824; but no importance was attached to them until about nine years afterwards, when they were first erected at the works of a Metropolitan Company then established, the engineer of which laid claim to, and patented the invention." Unfortunately, after most diligent search among the patent records, the writer is compelled to acknowledge that he has failed to find the slightest clue to any such patent. Whoever invented the telescopic holder did not consider it worth while to pay the very heavy fees at that time necessary to protect an invention.

Why, then, was the telescopic holder not met with prior to 1834? Certainly not because gas engineers were blind to its advantages, which were so obvious that they would have been seized hold of immediately had the hands of the early promoters of the gas industry been free to do so. The reason for the tardy reception given to the holder lay in the ignorance and consequent fear with which the general public regarded a gasholder. The works built by the earlier companies were generally placed right in the centre of the most populous neighbourhoods, where land was dear and room for extensions limited. Gladly would the engineers have adopted a device by which they could have at once doubled their storeage accommodation without increasing the acreage of the site of the works. But how was this to be done in the face of popular prejudice? In the days of Peckston, a store of coal gas was looked upon as first cousin to a store of gunpowder; and it hardly required the *ipse dixit* of the Fellows of the Royal Society to convince the general public that, if they wished to sleep peaceably in the neighbourhood of a gasholder, they could only do so on condition that the latter was of moderate dimensions, housed in a special building, and kept secure under lock and key.

The promoters of the new industry did all they could to combat this fear—even resorting, when necessary, to practical experiment of a novel description. Clegg tells us with much gusto how his father received in the gasholder-house a deputation from the Royal Society; how he called for a pickaxe and a lighted candle; how he struck a hole in the side of the holder with the former, and ignited the out-rushing stream of gas with the latter; how every man lived to tell the tale; and how some were convinced, but others, like Pharaoh of old, "hardened their hearts" and would not believe. Gradually, however, these early fears died away, and, as already stated, the

* Patent No. 5465 of 1827.
† Patent No. 12,398.
‡ Patent No. 2564.
§ See JOURNAL, Vol. XXXV., p. 997.
‖ Patent No. 206.
¶ See JOURNAL, Vol. XIII., p. 240.

* Patent No. 4154 of 1817.
† Patent No. 4351 of 1819.
‡ Patent No. 4184 of 1817.
§ Patent No. 18,607.
‖ See JOURNAL, Vol. LX., p. 1084.
¶ Patent No. 4188.

telescopic holder was introduced in the year 1834, if not prior to that date.

As at first designed, the section of the water-joint of the telescopic holder was rectangular; the bottom of the cup and the top of the grip being formed of plate iron, attached by angles to the sides of the outer and inner holder, and to the sheets forming the annular lute. The first improvement introduced was the substitution of a plate of channel-iron, either specially rolled or forged, for the flat bars and angles formerly used. The channel-iron materially strengthened the joint, as it only necessitated the use of two instead of four rows of rivets. The credit for this improvement is, according to Clegg junior, given to Mr. Walter Mabon, a manufacturer of Ardwick, near Manchester, and justly so, although a cursory glance over the patent lists would lead one to suppose that it ought to go to the account of one Joshua Horton, who, in 1851, took out letters patent* for various improvements connected with the construction of gasholders, among them being the following: "My third improvement," he says in his specification, "consists in forming the top and bottom of the water-cup, or hydraulic joint, of gasholders of sheet or plate iron, wrought to the shape required for such parts, instead of using angle-iron, or sheet-iron, bolted or riveted together, which renders the manufacture more costly." This claim on the part of Horton was, however, subsequently contested, and with success, by a well-known firm of gasholder builders (Messrs. T. Piggott and Co.), who were able to prove that channel-irons had been used for some time prior to the filing of his patent, by Mr. Walter Mabon.

But the greatest improvement ever effected in the construction of the hydraulic cup was undoubtedly the unpatented invention of the late Mr. George Piggott, who, in 1862, formed it of bent plates, in the well-known method now almost universally adopted in gasholder construction. This form of cup has given general satisfaction; and though opinions may differ as to its superiority over the channel-iron cup, as was seen in the interesting discussion carried on in the JOURNAL in 1889, it is noteworthy to remark that the cups of the three largest holders at present in existence are made of bent plates, as introduced by Mr. George Piggott 32 years ago.

(*To be continued.*)

* Patent No. 13,436.

TECHNICAL RECORD.

NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.

Annual Meeting in Boston.

The Twenty-Fourth Annual Meeting of this Association was opened on the 21st ult. by the President (Mr. C. H. Nettleton, of Birmingham); and there was a numerous attendance. After electing several new members, and other businesss, a congratulatory telegram was forwarded to the Michigan Association, who were holding their first annual meeting that day.

The President then delivered an address, in the course of which he deplored the fact that the past year had shown a general falling off in the demand for gas. Few were now sending out so much as at the corresponding period of last year. He regarded the gas demand as an excellent indicator of the general state of trade. As the earning capacity of people decreased by the hard times, so was the ability to purchase lessened; and one of the first economies was the lighting bill. This was shown by the fact that electric light companies were experiencing a similar period of depression. He believed that more oil was being used, not because people liked it, but because it was cheap; and that with more prosperous times, the public would return to gas. The problem of "dollar gas," he remarked, had been solved in New England, under circumstances and conditions that were far from pleasing to most of the members, though it only appeared a question of a short time when it would be reached under ordinary conditions in a great number of places. The gas-stove trade continued to increase very satisfactorily; and in some of the large cities, flats were now erected with no other provision for cooking food than a gas-stove. The owner warmed the whole building by some means; and the tenant agreed to use no solid fuel. This illustrated the possibilities of gas; and offered them encouragement for pushing the sale of gas-stoves. There was at the present time a marked change in the attitude of gas engineers towards water gas. Many members were now making both kinds of gas; and speaking from personal experience, he could testify that a water-gas plant was a very convenient and useful adjunct to a coal-gas works. The tendency of the general public towards ownership of many things—gas undertakings among others—was next remarked upon. To his mind it appeared impossible, with the "make-up" of local government that obtained in most of their cities, for anything in a public way to be managed on strict business lines, and with anything like the economy that a man would use in his own personal affairs. Give a private company the exclusive supply of gas, under reasonable restrictions, and results would follow that never could be obtained under municipal ownership; and the advantage could be further increased by a sliding scale of prices and dividends. In concluding, the President alluded in hopeful terms to the future of the gas industry. He believed gas would continue to be used for light; that it would be made better, and used with greater economy; that it would be manufactured and sold at cheaper rates; and that the industry would go on in the future, gaining in strength, and continually widening its sphere of usefulness.

Mr. C. J. Russell Humphreys, of Lawrence (Mass.), read a paper on the "Advantages of a Combined Coal and Water Gas Plant." He argued that if a man directed his sole attention to the making and selling of gas, he should be able to get better results than are secured by spreading his energies over several outlying fields. Taking the raw material coal, and dividing it into gas, coke, tar, and ammonia, it was a fairly debatable question which was the primary and which were the residual products. The ordinary process of making coal gas produced a relatively small amount of gas, and a large quantity of bye-products. It was generally claimed that the latter helped to pay the dividend. The truth, however, was that a large portion of the time of the manager and his office force was spent in matters connected with the residuals; but the whole of the establishment charges were placed upon the gas. In order to get a fair idea of the actual receipts for residuals, the whole of the office time and other expenses necessary for their disposal should be charged against them. If this was not done, they appeared to be more valuable than was really the case. Besides this, some share of the interest on capital was fairly chargeable to residuals; sheds, tanks, and other appliances had to be purchased for the purpose. He claimed, therefore, that the greatest chance of success might be reasonably expected on the lines of the proposition that gas engineers should be essentially gas makers. The way to attain this end was to convert, as far as possible, the residuals into gas, which meant a combination of coal and water gas. A ton of coal yielded about 375 lbs. of gas, 1560 lbs. of coke, and 116 lbs. of tar. Assuming that the tar and 20 per cent. of the coke was used as fuel under the retorts, 1254 lbs. of coke would remain. This could be made to yield 35,000 cubic feet of water gas. Then $4\frac{1}{2}$ gallons of oil per 1000 cubic feet would be required to carburet it; and thus one ton of coal and ($4\frac{1}{2} \times 35$) gallons of oil would yield 46,500 cubic feet of gas. Putting a as the cost of coal per ton, and b as the cost of oil per gallon, then

$$(1)\quad \frac{a + (b \times 35 \times 4\frac{1}{2})}{46{\cdot}5} = \begin{cases} \text{cost of coal and oil} \\ \text{per 1000 c. ft. of gas.} \end{cases}$$

To compare this with coal gas, let a = cost of coal as before, c = the actual percentage returned by the residuals, and allow 9 gallons of oil as enricher. Then

$$(2)\quad \frac{a + 9\,b - a\,c}{11{\cdot}5} = \begin{cases} \text{cost of material for coal gas} \\ \text{per 1000 c. ft.} \end{cases}$$

The ammonia would be recovered in any case; so, in comparing its value should be added to (1). But there were other items to be considered. The cost of labour per unit of make might be put at 1 for water gas, and 4 for coal gas; so that the combined plant afforded a large saving in labour. Anyone could put the proper values to these factors for any gas undertaking; and it would be found that the higher the value of a, the greater the advantage of (1) as compared with (2). The coal gas would be of only 18-candle quality; but the mixed gases would be of 23-candle power. Almost every gas undertaking, however, had a certain demand for residuals at good prices. When the production over-ran this demand, they had to accept lower terms. Here the advantage of the combined plant came in, as all that could not be disposed of promptly for good cash prices, could be converted into gas. He held that a modern gas-works should consist of a combined plant, having retorts and generators under one roof, so that the coke could, when required, be transferred direct from the retort to the generator. The water-gas plant was a great help in meeting sudden fluctuations of demand or labour troubles; and it also made some control over the price of raw materials possible.

Discussion being invited, Mr. Gifford asked if any case could be cited where the whole of the residuals were converted into gas, and there was no coke or tar for sale. Mr. Neal preferred anthracite to coke for the generators, as the coke was apt to cause clogging in the superheater. He did not, however, have the second superheater, as now generally used; and perhaps that explained the trouble. Mr. Fowler had used his surplus coke for generating steam, with the result that, for every ton of coal used in the first place, he could raise 9000 lbs. of steam. Mr. Coggshall had an electric light plant; and he found that 16s. 8d. per ton represented the value of coke to him as fuel, as compared with the price of coal. So all that would not realize that price was taken into his electric light station, and there used. Mr. Beal had worked a combination plant for some years, with the result that he was drifting towards making one kind of gas only—namely, water gas. He could get a very good price for his residuals; and he found it paid him to use coal in the generator and to sell the coke. Especially if gas of above 20-candle power was wanted, the advantage of water gas became evident; and he thought that many besides himself were moving that way. Mr. Benson did not agree with some of the points in the paper. He believed in having plant for both water and coal gas—but separate and distinct, and in no way dependent on each other—so that they could make anything between all water or all coal gas. He adopted this plan some years ago; and as the respective plants were entirely distinct

up to the meters, he knew exactly what each kind of gas cost. At present, he was making two parts of water to one of coal gas. He also found it advantageous to buy coal for the generators, and reserve the coke for sale, as it would realize 5d. per bushel. Indeed, he was now considering the advisability of using oil for fuel. He had been told that coke was only worth 7s. 3d. per chaldron for the generators, and that with the same apparatus it only yielded 75 per cent. as much gas as coal; otherwise he strongly recommended the use of both kinds of gas plant, for the reasons suggested in the paper. Gas of 20-candle power and upwards could certainly be made cheaper by the generator system than by the retort process. Mr. Lamson agreed that the proper condition for a modern gas plant was to have it so arranged that the whole quantity sent out could be either coal or water gas as preferred. A mixed gas in equal proportions was the best for the consumer; and he adopted this plan. It enabled him to control the price of his residuals; and sometimes he bought coal for the generators and sold the coke. He would not, however, follow Mr. Beal in going over entirely to water gas. Captain White agreed that the most advantageous method of operating gas-works of any size was to make both coal and water gas; and he also thought that the two plants should be entirely separate and distinct up to the meter. Some supposed that the two gases would not mix well; but the general experience was that they could be safely turned into the mains together, without even going through the holders. At Denver, he had been able to get as good results from coke in the generator as from anthracite. Mr. Shelton, while agreeing with the previous remarks, said the question of improved candle power had not been sufficiently brought out. In view of the competition to which they were exposed, it was important that they should be able to make high-power gas.

Mr. Humphreys, in replying, said that he knew of no case where the whole of the residuals were actually converted into gas. He had at times used all his tar for fuel, but had always sold some coke; and he believed there was always a sale for a certain quantity of coke, at a good price. Although he had an electric light station, he never used coke under the boilers, because he could get coal screenings very much cheaper. He did not intend to imply, in his paper, that the two systems should be so mixed up as to prevent getting separate results; but he was speaking more particularly with medium-sized plants in mind. In Mr. Benson's large works, a different rule might hold good. Keeping the generators and retorts under one roof meant a saving of labour and fuel; and it did not prevent the remainder of the plant from being distinct and separate. He did not think that mixing in the mains would answer, unless there was a long length to mix in. There was no reason why coke should not yield as much gas as anthracite, pound for pound, in the generator. Mr. Shelton had directed attention to an important point that was not sufficiently emphasized in the paper.

(To be continued.)

THE SCIENCE AND PROGRESS OF GAS COMBUSTION.

As briefly noticed in the JOURNAL last week, a paper on the above subject was read at a recent meeting of the Liverpool Engineering Society by Mr. C. R. BELLAMY, Superintendent of the Gas Department of the Liverpool Corporation. The following is an abstract of the paper.

In his opening remarks, the author stated that if he had written his paper before fixing the title, the latter would have read: "The Progress of the Science of Gas Combustion," as it was obviously of more interest to the engineer, in a paper of this character, to deal with the march of practical results than with the causes which led up to them. The strictly scientific considerations had therefore been omitted; and the paper would partake more particularly of the character of a *résumé* of the work accomplished in the direction of improved methods of gas combustion, having for their object the attainment of a higher lighting duty from coal gas. He then went on to say that the consideration of such a subject would not appear as one of much interest to the casual observer; but, taking into consideration the magnitude of the gas industry in this country—which, though having a history of barely a century, involved an annual coal consumption of 11 million tons, and the production of 111,000 million cubic feet of gas, realizing, with residual products, upwards of 18½ million pounds sterling—and, when it was known that one burner might develop ten times as much light as another with the same consumption of gas, it would be seen that the matter was of sufficient importance to warrant investigation.

Mr. Bellamy next quoted the report presented to the Board of Trade by the Gas Referees in 1871, to show that, as the result of testing a large number of gas-burners removed from various public buildings and places of business, the greater portion of them were found to give out only one-half, and some not more than one-fourth, of the light which might have been developed from the gas. If this rate of waste were applied to the gas-rental of the country, the enormous loss to the community, due to ignorance of the simple laws governing gas combustion, would, he said, be apparent. Since the date of that report, great progress had been made in the manufacture of gas-burners and in perfecting the details of gas combustion. But there had not been that general recognition by the public that should have followed; and it was safe to assert that from 20 to 25 per cent. of the gas used for lighting purposes to-day was wasted—occasioning not only a monetary loss, but also interfering with health and comfort. He thought that one of the principal causes of this state of things was that gas authorities had chiefly applied their energies in the direction of improving the quality and lowering the price of their commodity; thus allowing the fitting of houses with gas appliances to get into the hands of a class of men who were chiefly interested in selling the cheapest and most inferior article at an enormous profit, regardless of its suitability or economic principles. This type of person was known as a gas-fitter, unless he styled himself a gas engineer; but in either case it would be well to bear in mind that, with rare exceptions, he was densely ignorant of the technology of his calling, and could not therefore be regarded as a source of reliable information. It was the hope of the author that his paper might supply some reliable data upon the subject of gas lighting which would be of service to the members of the Society, when, in the course of their multifarious duties, they had to deal with the problems of gas lighting.

Before dealing with the various forms of burners and the improvements effected therein, Mr. Bellamy defined some of the terms he would have to employ. Taking illuminating power first, he said he thought the standard candle was very unreliable and unscientific, and was only used where statutory or official obligations required it, as the precautions and calculations necessary to correct its vagaries were great, and only partially successful, so that its use was dispensed with wherever permissible. The standard of light more commonly used was the Methven screen. Having described this instrument, he then proceeded to point out that the mere expression "candle power of coal gas" is not very instructive, unless the burner by which it is measured is referred to. There were, he said, several standard burners in use in this country, which gave very divergent results. He showed four which had come under his immediate notice—viz., (1) The 15-holé Argand, (2) the Silber Argand, (3) the "London" Argand, and (4) Sugg's No. 7 steatite batswing. The two last-named were, he explained, those adopted by the Gas Referees—the "London" Argand for testing gases varying between 14 and 18 candle power, and the batswing for those of higher illuminating value. The unit efficiency of these four burners with Liverpool gas was: (1) 3·24 candles, (2) 4·19 candles, (3) 3·8 candles, and (4) 4 candles. The importance of describing the form of burner used, when referring to the candle power of gas, would be apparent. The author thought it was distinctly unfortunate, for comparative purposes, that there was not one standard of illuminating value for coal gas applicable to the whole country, and one standard burner prescribed for its measurement; and he said it would no doubt cheapen gas considerably if the illuminating standard were fixed at a point which would enable the gas to be produced from ordinary coal. A great advantage of such an arrangement would be that one form of burner would be usable throughout the country; whereas, under the present condition of things, such a burner as the batswing had to be made to three or four different gauges to suit gases varying between 14 and 20 candle power, if the best results were to be obtained. This refinement of burner manufacture, although very important, was rarely carried out in detail; and therefore thousands of burners, made in different parts of the country for gas of low illuminating power, were used locally, to the great detriment of the gas.

Having explained the terms "duty," as applied to a burner, and "pressure," as regards the supply of gas thereto, Mr. Bellamy proceeded to describe, from "Accum," the earliest form of burner—the "cockspur." Contrasting this with a single-jet burner of modern type, he showed that the gas, when lighted, ascends in a stream—rising until it comes into contact with sufficient oxygen to complete its combustion. To prevent the flame becoming unduly long, it was, he said, necessary to restrict the orifice; and the gas, issuing at considerable pressure, tended to draw in the air and mix with it in its course. This resulted in a considerable loss of illuminating power, evidence of which was afforded by the well-known Bunsen burner. He then made some brief general remarks upon the chemical and physical properties of a gas-flame, with the view of illustrating the bad effect of excessive pressure; and he showed that any system which has a tendency to keep the temperature of the flame high, with a low velocity of the issuing stream of gas, must be a beneficial one. All improvements in the methods of gas combustion had been in this direction. The main defect in the old "cockspur" burners was that the flame obtained with them was very unstable—being affected by the most trivial atmospheric movement. This led to the introduction, about 1816, of the "batswing," and about 1822 of the "fishtail" burner; the latter being the product of the united labours of Mr. J. B. Neilson and Mr. J. Milne—the first-named gentleman being at that time Manager of the Glasgow Gas-Works, and Mr. Milne being the founder of the well-known engineering firm of Messrs. J. Milne and Sons, of that city. The utility of both of these burners had been further enhanced by forming them wholly or in part of non-conducting material, such as adamas, enamel, or steatite. The author exhibited two burners of each of the new types, and showed that the unit efficiency of the fishtail had increased from 1·66 to 3·09 candles, and that of the batswing from 3·01 to 4 candles. He stated that the increased efficiency of the new over the old type

amounted to 47 per cent. in the case of the former, and to 25 per cent. in that of the latter burner. These results were obtained by adjusting the pressure to the requirements of the burner. This was a most important matter. There was for every form of burner one pressure at which it would yield its most economic results; and various efforts had been made to maintain it. Gas was forced through the mains at a much higher pressure than it was desirable to have at the burner. This could not be avoided, owing to the variation of level in the districts supplied, the distance to which it had to be sent, and other causes. The extreme variation in Liverpool was between 1 and 2·8 inches, which was very moderate, owing to the efficient system of mains in use. In many towns, however, the range of pressure was between 0·5 and 4 inches.

The author then went on to say that the effect of variations in pressure on the consumption and illuminating power of gas had been so disastrous, that governors, for automatically adjusting the flow of gas to any desired pressure, had been introduced. These instruments had passed through many changes; but they might be regarded as having now reached the maximum of efficiency. A governor of the best type would maintain the pressure absolutely at any desired point through all the ranges of pressure referred to. There were two principal forms—viz., main governors, for controlling a number of lights; and the single form, for governing the burner to which it was attached. The latter combination was by far the more efficient, and undoubtedly constituted the most important improvement effected in connection with the combustion of gas. The following table—giving the results of consuming gas by means of governed and ungoverned burners—demonstrates the extent of this improvement:—

Description of Burner.	Pressure. Inches.	Consumption. Cubic Feet.	Unit Efficiency. Candles.
Governor burner, rated at 5 cubic feet per hour	0·5	5·00	4·20
	1·0	5·00	4·20
	1·5	5·00	4·20
	2·0	5·00	4·20
	2·5	5·00	4·20
	3·0	5·00	4·20
Ordinary ungoverned burner No. 4	0·5	3·90	3·00
	1·0	5·60	2·40
	1·5	7·00	1·90
	2·0	8·45	1·50
	2·5	9·60	1·35
	3·0	10·50	1·11

Referring to these figures, the author explained that the ungoverned burner was one of the ordinary type of brass-cased fishtails, which constitute between 80 and 90 per cent. of the total number of burners at present in use; and he remarked that, though useful by comparison with its progenitors, it must eventually be superseded by the batswing in combination with the governor or other improved form.

Before leaving the subject of flat-flame burners, Mr. Bellamy made reference to the use of globes. He said these had been very much improved during the last few years, both in form and suitability of the material employed. The old type, with a restricted opening at the bottom, caused the air to rush in with considerable violence, resulting in great unsteadiness of the flame, and an actual diminution in the yield of light. The new form—known as the "comet" or "moon"—was of real assistance to the flame when placed in its right position relatively to the burner, which is when the bottom of the globe and the top of the burner are in the same horizontal plane. In this position, the globe exerts a steadying influence on the flame, and assists in maintaining a higher temperature about it. The absorptive power of the commoner type of globe is very great, varying between 25 and 40 per cent.; but with the better form, manufactured of a description of glass known as "albatrine," the absorption, when measured on the horizontal line, does not exceed 18 per cent. In explanation of this apparently low result, the author pointed out that, in the use of such a globe, while there is necessarily absorption on one side, there is considerable reflection at the back of the flame from the other. Thus, if an "albatrine" or opal globe were split in half vertically, and the front half removed, it would be seen at once that the back half acts as a very powerful reflector. It is really doubtful, he thought, in point of general illuminating effect, whether there is any loss of light by the use of a properly-constructed globe, as there is considerable reflection upwards and downwards to compensate for the deficiency on or near the horizontal line. He showed photometrical results obtained from a flat-flame burner, measured at angles of 10° from the vertical above to the vertical below, obtained by Mr. Dibdin with his radial photometer. They indicated, at a glance, that there is very little, if any, loss of light by the use of a suitable globe; while the general advantages consequent upon its use are obvious.

Passing next to the subject of the Argand burner, the author remarked that this had a higher efficiency than those of the flat-flame type; but this superiority had not been sufficient to counteract the disadvantages attendant upon the use of the glass chimney, and therefore it had not come into very general favour. Some improvements had, however, been made in it, the aggregate effect of which was increased efficiency. There had been a variety of modifications and improvements in the "London" Argand, the details of which he had not time to give.

The other burners noticed by Mr. Bellamy were those of the regenerative and incandescent types. He stated that the principal feature of the former class was the conveyance of air for supporting combustion through chambers heated by the gas-flame; resulting in an increased temperature of the flame itself, and an additional lighting efficiency of about 25 per cent. over that of the best form of flat-flame governor burners. They had not been adopted in the general manner first expected, owing largely to the amount of attention they required; but for combining ventilation with lighting, where the diffusion of the products of combustion was objectionable, they were invaluable. He showed a sample of one of the smallest of its type. It was rated at 3·9 cubic feet per hour; and it yielded a light equal to 26·99 candles—showing a unit efficiency of 6·92 candles. This was the most generally useful burner of its class.

With regard to the incandescent burner, Mr. Bellamy made the following remarks, and with these his paper closed: This is a form in which the "Bunsen" burner with a non-luminous flame is used; light being obtained by enveloping the flame in a garment of some refractory material capable of being raised to a useful state of incandescence. The earliest examples were those of Clamond and Lewis; the former employing a mantle of magnesia spun into threads, the latter a cage of platinum wire. Both required an artificial blast of air; and therefore could not be placed on the list of appliances applicable to ordinary conditions. They were, however, the forerunners of the form of burner which, in my opinion, is destined to entirely revolutionize both gas lighting and gas manufacture. Sir John Conroy stated before the Royal Society in 1891, as the result of elaborate experiments, that the total radiation from the Argand gas-burner was composed of 1·75 per cent. of luminous, and 98·25 per cent. of non-luminous rays. It has always been regarded as a reproach to mechanical engineering that the best steam plant only gives a useful duty of about 10 per cent. of the theoretical capabilities of the fuel burnt in a boiler furnace. This, however, appears a favourable result in contrast with the gas-burner, which wastes 98·25 per cent. of the gas it consumes, so far as lighting effect goes. The gas cannot be burnt without heat; but it would appear that a system which ignores the light-rays of 1·75 per cent., and utilizes the heat-rays of 98·25 per cent., is likely to secure the most economic result. This system is practically embodied in the incandescent burner before you, which is a modification of the Welsbach burner introduced in 1886. Mr. Bellamy, having briefly described the burner, proceeded: As the result of numerous tests, the author is enabled to state that this burner has a unit efficiency of 19 candles; and when this is compared with the 4 candles of the best type of flat-flame burner, the enormous advance in light-production will be apparent. An appliance which suggests the possibility of a reduction in the gas bill of 75 per cent. inspires respect; and with care, allowing for new mantles, a light could readily be obtained at a reduction of 50 per cent. as compared with that of the best type of ordinary gas-burner. Already there are signs that the great failing of these burners—viz., the fragility of the mantle—is likely to be overcome; patents having been secured for the construction of a mantle with a platinum woven base, which it is stated can be readily handled without fear of fracture or injury. If such a mantle is available, it is clear that a great revolution may take place in gas manufacture, since it would no longer be necessary to supply a luminous gas. It has already been discovered that in some towns half the total gas consumption takes place during the hours of daylight—for motive, cooking, and other purposes. This gas is used at great disadvantage, since a non-luminous gas, made at much lower cost, would be quite as suitable. If the incandescent burner became practicable for all lighting purposes, it is clear that a non-luminous gas which would meet all requirements could be sent out for about 1s. per 1000 cubic feet. Such a reduction in price would, no doubt, be followed by an enormously increased use of gas for motive and fuel purposes generally. In a paper recently contributed to this Society, entitled "The Public Supply of Electrical Energy—Its Cost and Price," a comparison was set up between the cost of a 16-candle power gas-light in Liverpool, with gas at 3s. 4d. per 1000 cubic feet, and that of a 16-candle power incandescent electric light—the former being shown at 0·2d., and the latter at 0·4d. per hour; and the hope was expressed that within a reasonable time electrical energy would be supplied at such a price as to reduce the cost of the incandescent electric light to that of gas. If the comparison had been made with Liverpool gas used with the incandescent gas-burner, the relative prices for maintaining a 16-candle power light, or its equivalent, would have read: Gas, 0·03d.; electricity, 0·4d.—showing that an incandescent gas-light can be obtained at 1·13th the cost of an incandescent electric light. This may be taken as a fair comparison, seeing that the cost of maintaining the lamps in both cases would be about equal. The incandescent gas-burner may be said to mark the extent of the progress that has been made up to the present in the construction of apparatus for developing light from coal gas.

The paper was followed by an interesting discussion.

The Recovery of Bye-Products from Coke-Ovens.—Mr. W. Schroller, of Durham (formerly with Mr. Henry Simon, of Manchester), has just completed two blocks of Simon-Carvès ovens for the Durham Coke and Bye-Products Company.

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

Estimating the Illuminating Value of Gas by its Calorific Power.

SIR,—M. Aguitton appears, by his letter in this week's JOURNAL, to have misread my remarks on the above subject. The calorific powers I quoted in my article were not calculated from the *elementary* composition of the gases, but from their component hydrocarbons and other constituents. The respective calorific values assigned to the constituent gases were those of MM. Berthelot and Matignon's latest determinations with the calorific bomb (see JOURNAL, Vol. LXII., p. 166).

March 22, 1894. JOHN T. SHEARD.

The Driffield Gas Question.—The shareholders of the Driffield Gas Company have ratified the provisional agreement made by the Directors and the Local Board, whereby the Company agree to withdraw their Bill; and they have also consented to the transfer of the works to the Board on fair and reasonable terms.

Additional Borrowing Powers for the Stratford-on-Avon Water Department.—It was reported by the Water Committee at a recent meeting of the Stratford-on-Avon Town Council that the Local Government Board had sanctioned the borrowing of £8163 for the purchase of an estate and land required for a service reservoir, £3788 for the construction of the reservoir and other works, and £1269 for water-meters and filtering material—the first loan being for fifty, the second for thirty, and the third for ten years.

The Arrol-Foulis Retort-House Machinery on the Continent.—The Imperial Continental Gas Association have lately decided to introduce labour-saving machinery into their Vienna station, and they have given Sir William Arrol and Co., Limited, an order for the complete outfit for three houses. This plant consists of eight of the Arrol-Foulis drawing-machines, and eight of their charging-machines, as well as elevators, hoppers, coal-breakers, and the necessary engines. Similar machinery was introduced into the Amsterdam Gas-Works a few years ago; and a further extension (making the fourth since the first employment of this plant) is now being carried out, for which three additional charging-machines, provided with hydraulic cranes for lifting the coal, are required.

The Electric Lighting of the Thames Embankment.—At the meeting of the London County Council last Tuesday week, the Highways Committee brought up again a recommendation which had been referred back to them for further consideration, on the subject of the electric lighting of the Thames Embankment. The Committee's original proposal was that the Embankment should be lighted by lamps placed on columns located in the middle of the road, as, if the lamps were placed along the kerb, they would have to be very high, or the trees must be cut. A reconsideration of the subject did not lead them to alter their opinion. Mr. Roberts moved an amendment to the effect that it was absolutely unnecessary to light the Embankment in the manner proposed; and if the Council adopted the recommendation it would show that they had no sympathy with the architectural beauty of London. Mr. Benn, M.P., seconded the amendment, which was supported by Mr. John Burns, M.P., Mr. Beresford-Hope, and other members, and ultimately adopted.

The Danger to Gas-Pipes from the Proximity of Electric Cables.—The increased responsibility thrown upon gas companies now that their mains have such dangerous neighbours as electric cables has just been exemplified by a case which for some time occupied the Paris Tribunal. About three years ago an explosion of gas occurred at the Larne Restaurant in Paris, which was lighted by this illuminant and also by electricity; the former being supplied by the Paris Gas Company, and the latter by the Popp Company. As two parties were concerned, and as each tried to put the blame on the other, the Court had some difficulty in apportioning the liability. It was proved that there were holes in the gas-pipes which allowed the gas to escape into M. Larne's cellars. On the other hand, there would, it was contended, have been no holes had there been no short-circuiting between the pipes and the electric cables. The damage caused by the explosion was estimated at 300,000 frs. M. Larne claimed 100,000 frs. for wine lost; and the insurance companies also put in heavy claims. We learn from the *Electrical Review*, which recently contained a summary of the case, that the total amount of damages granted is 176,000 frs., of which the Popp Company are to pay three-fourths and the Gas Company the remainder.

A Dispute as to the Laying of Water-Mains at Llandrindod.—A short time ago, Sir Douglas Galton, K.C.B., conducted an arbitration, on behalf of the Board of Trade, at Llandrindod, under the local Water Company's Acts of 1884 and 1893, to determine a dispute which had arisen between the Company and the Local Board. From the statement made by Counsel, it appeared that the Local Authority have powers under the Acts to purchase, at a fair and reasonable price, the water-works; but this they cannot do for some years. The Company have to obtain the consent of the Board to lay new mains; and in August they applied for permission to put down 3-inch mains for the purpose of supplying a portion of the parish with water. The Board refused to approve of the scheme, and inserted 6-inch mains, on the ground that their Engineer had formulated another scheme for the supply of water to the district; and consequently the extensions proposed by the Company have not been carried out. The matter was therefore reported to the Board of Trade; and at the arbitration an attempt was made to enter into the details of the proposed scheme, which was resisted on the ground that it was not reasonable or equitable to compel the Company to make provision for a scheme which was not, and could not be in existence for some years, besides throwing upon them an enormous and unnecessary expenditure of capital. Sir Douglas Galton upheld this contention; and, evidence having been called on both sides, the Arbitrator closed the case, and stated that he would immediately present his report to the Board of Trade for their consideration.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Wednesday, March 14.

(*Before Justices* CAVE *and* WRIGHT.)

Yorkshire (West Riding) County Council v. Holmfirth Urban Sanitary Authority.

This was an appeal by the plaintiffs from a decision of the County Court Judge of Holmfirth, who, in certain proceedings under the Rivers Pollution Prevention Act, gave judgment for defendants.

Mr. FINLAY, Q.C., and Mr. C. M. ATKINSON appeared for the plaintiffs; Mr. LAWSON WALTON, Q.C., M.P., and Sir G. MORRISON represented the Sanitary Authority.

Mr. ATKINSON, in stating the case, said that, under the Local Government Act of 1888, the County Council had imposed upon them the duty of enforcing the provisions of the Rivers Pollution Prevention Act. The West Riding County Council took proceedings against the Holmfirth Local Board, who were the Urban Sanitary Authority for the Local Government Board district of Holmfirth, which contained about 9000 inhabitants, and the sewerage system of which consisted of five or six main sewers running down through the town, and discharging themselves into two small rivers—the Ribble and the Holme—which ultimately flowed into the Calder. The Holmfirth Authority had, from time to time, laid down pipes in connection, as they said, with a contemplated system of main drainage. They had taken up the ancient rubble sewers, and substituted pipes; and in some instances they had altered the levels. The houses were connected with the pipes; and, under these circumstances, the sewage was discharged into the Rivers Ribble and Holme. It was complained, on behalf of the County Council, that no attempt was made by the Holmfirth Authority to purify the sewage; and, this being so, as it was "knowingly permitted to fall or flow into the stream," an offence had been committed under the Rivers Pollution Prevention Act. Further, it was said that an offence had been committed because one of the outlets was a new one, made by the Local Board since the passing of the Act of 1876.

Justice CAVE pointed out that the County Court Judge had appended these words to his notes: "Both plaintiffs and defendants seemed disposed to consider this an end of the case; and, not pressing for an exercise of discretion as to granting or withholding an order under section 10, I allowed it to be treated as a conclusion in favour of the defendants." The Judge therefore thought there was no longer any controversy between the parties, and entered judgment for the defendants.

Mr. ATKINSON assured their Lordships that on this point his Honour was mistaken.

Mr. FINLAY contended that the substitution of pot-pipes for the old rubble drains increased the flow of the sewage, and everything was carried into the river. Then he ought to point out that the defendants had a sewer which discharged into a mill-dam belonging to a Miss Garside. Complaints were made of a nuisance caused by this; and the Local Board took up the sewer there discharging, and, instead of allowing it to empty itself into the mill-dam, they made a new sewer, and conducted it straight into the river. The result of this was that the sewage, instead of settling, to some extent in the mill-dam, was discharged right into the river. He submitted that it was impossible, under these circumstances, for the defendants to say that they did not "cause to fall or flow, or knowingly to permit to fall or flow, into the stream, solid or liquid sewage matter," as prohibited by the Act. In fact, they most certainly committed an offence against this section.

Sir G. MORRISON pointed out that the Act of Parliament under which the plaintiffs proceeded was not in force when the alleged offence was committed. There could, therefore, be no "permitting" within the meaning of the Rivers Pollution Prevention Act of 1893; and as, under the previous Acts, the Local Board could not be made responsible, he submitted that it would be unjust to penalize the defendants by means of *ex post facto* legislation. In support of his contention, Sir George cited the Glossop and Dorking cases, the latter of which, he said, established the proposition that where a sanitary authority have not themselves constructed sewers which are a nuisance, but only permitted them to be used as formerly by the inhabitants, they are not doing an act which can be restrained under the Public Health Act and the Rivers Pollution Act, 1876. This case was entirely in his favour. It was quite true that by the Act of 1893 the Legislature had probably neutralized the effect of the Dorking case by enacting that, where any sewage matter falls or flows into any stream after passing along a channel vested in a sanitary authority, the latter shall, for the purposes of the Rivers Pollution Act, be deemed to knowingly permit the sewage so to fall; but it must be borne in mind that this Act came into force on the 27th of July, 1893, while the summons in this case was issued a month earlier, and the Act of 1893 was clearly not retrospective. The turning of the rubble drains into pot-pipe sewers did not necessarily increase the flow of sewage; and, as a matter of fact, he was instructed that no increase in the flow of sewage took place. With regard to what had been done upon Miss Garside's property, the sewage was simply put into the stream at a different place, where the flow was better. The County Court Judge did not find that the alteration upon Miss Garside's property, or the substitution of pot-pipes for rubble drains, had led to an increase in the flow of sewage.

Justice WRIGHT said it appeared that there was no express evidence that the substitution of pots for rubble, or the change of drainage at the mill-dam, had led to an increase. They must therefore take it that nothing had been done by defendants to increase the flow of sewage.

Mr. ATKINSON admitted that there was no evidence of this kind; but he said that, in view of the authorities, he did not think this question was of any importance.

Justice CAVE (to Sir G. Morrison): Do you admit that if proceedings were taken against you *de novo*, you are liable?

Sir G. MORRISON said that, for the purposes of argument on that occasion, he would admit it; and he went on to contend that, under the authorities, his clients were not subject to these proceedings.

Justice CAVE said he was of opinion that the appeal must be allowed, as it appeared to him that, quite apart from the Act of 1893, there was evidence to satisfy the Judge, and which ought to have satisfied him, that the defendants were knowingly permitting this sewage to fall into the river within the meaning of the Rivers Pollution Prevention Act, and that he ought to have called upon them to show—if they could show—that they had adopted the best possible means of rendering the sewage matter harmless. The Court did not feel it necessary to make any order at that moment, because the evidence of what could or could not be done had not been given, and defendants were undoubtedly entitled to give evidence of that description, and to call upon the County Court Judge to exercise his discretion in the matter. They thought, therefore, that the only course they could pursue was to direct that the case should go back to the County Court Judge, with an expression of their opinion that, so far as he had gone, they thought there was sufficient evidence to bring the defendants under the section of the Act.

Justice WRIGHT was of the same opinion, and said it might be worth the while of the County Council to consider whether they should not institute fresh proceedings.

Mr. ATKINSON said this would involve long delay.

The appeal was allowed, with costs; but leave to appeal was given.

The Gaslight and Coke Company Fined for Sulphur Impurity.—At the Lambeth Police Court last Wednesday, The Gaslight and Coke Company were summoned by the London County Council for having, on Nov. 11 and 13 last, supplied, at the Lambeth Road testing-station, gas of less than the standard purity. Mr. T. Seager Berry, from the Solicitor's Department of the Council, appeared in support of the summonses; and Mr. Horace Avory, represented the Company. Mr. F. Beale, the Resident Engineer at the Nine Elms station of the Company, was called for the defence; and he explained that the excess of sulphur in the gas on the days in question was due to the failure of the tests to record the quantity. The amount of sulphur allowed by the Referees during the winter months was 22 grains per 100 cubic feet; but the Company's average for the winters of 1892 and 1893 was only 12·75 grains. Mr. Hopkins fined the Company £20 and 25s. costs, and said he would consider any application to state a special case upon a question of time, raised by Mr. Avory.

The Utility of the Divining-Rod Impeached.—In the JOURNAL for the 13th ult., a paragraph appeared, having reference to the use of the divining-rod at Bridgnorth. In connection with the statements then made, the following letter from Mr. Edward Morrall, which appeared in a Birmingham contemporary last week, will be read with interest: "Some time ago the Water-Works Committee of the Town Council of Bridgnorth engaged the services of a Mr. Mullins, who pointed out a spot where, if a well were sunk to a depth of from 30 to 35 feet, a spring would be found yielding a supply of 150 gallons of water per hour. Since that time various statements have appeared in your paper stating that spring water had been found at 26 feet, and that a good spring had been discovered at 30 feet. Notwithstanding this good supply, sinking operations have been going on. To-day [March 18] I have measured the depth of the well, and find it is 46 ft. 8 in. I have also had a conversation with the man employed in sinking the well. He informed me no spring had been found, only surface water found its way into the well, and described the bottom of the well, when he left work the previous day, as being 'as dry as an ashpit.' I shall be obliged if you will publish this information, so that your readers may know the value to place on the 'divining-rod' as a means of finding a supply of spring water. I was one of the two members of our Council who protested against public money being spent on such nonsense; and I think the foregoing information fully justifies the course we took."

The Charge for Water for Gardens.—At the North London Police Court on Monday last week, Mr. John James Roberts, of Mildenhall Road, Clapton, was summoned before Mr. Lane for £1 14s. 3d., being two quarters' water-rate due to the East London Water Company. Mr. G. Kebbell appeared for the Company; Mr. Pepyat Evans, barrister, defended. The defendant objected to 10s. a year charged for the use of water in the garden; and it was also asserted that the Company had failed to deliver a proper statement of account. Mr. Kebbell said the Company were not compelled by any statutory power to deliver any statement. Legally speaking, the consumer was bound to attend at the Company's office the day the supply was given, and tender a quarter's payment in advance. The defendant's house was assessed to the relief of the poor at £35. The value being above £30, the Company were entitled to make certain additional charges for a bath, &c., and such sum as might be agreed upon for a garden. The Company fixed the latter amount at 10s. per annum, as a garden hose was used. Defendant paid one quarter's rate at 17s. 1d., due from Lady Day to Midsummer; and Mr. Kebbell contended that such a payment was evidence of an agreement with the Company to pay 10s. a year for the garden. Mr. Lane asked why. Mr. Kebbell said because it was a simple matter of calculation. It was stated on the back of the notice what the Company might charge. If he added these amounts together, he would soon see that there was 10s. left for the garden. The defendant said he paid without question. When he did come to calculate, he wrote to the Company asking for particulars; and as the reply was not satisfactory, he disputed the whole amount. He never agreed to pay the Company 10s. a year for water for the garden. Mr. Lane asked why the particular items were not specified on the back of the demand-note. Mr. Jones, Chief Clerk to the Company, replied that it would be impossible to give the particulars to each of the 200,000 customers of the Company. Mr. Lane said it was the practice of other Companies to give particulars on the back of their demands. He should hold that, as the amount of 10s. for water for the garden was not specified, there was no evidence of agreement on the part of defendant to pay this amount; and so he should disallow it. Judgment would be given for the Company for £1 4s. 3d. Mr. Kebbell asked for costs; and Mr. Lane allowed 12s. 6d. He offered to state a case for the opinion of the High Court; but Mr. Kebbell said he would take time to consider the point.

MISCELLANEOUS NEWS.

THE ARTESIAN WELL OF THE COMMISSIONERS OF SEWERS OF THE CITY OF LONDON.

References have been made at various times in the JOURNAL to the artesian well which has been sunk by the Commissioners of Sewers of the City of London for the supply of artizans' dwellings near Houndsditch. The execution of the work was, it may be remembered, attended with numerous difficulties; but these were successfully overcome, and the well was completed by the end of 1892. It was carried out from the designs and under the superintendence of the Engineer and Surveyor to the Commissioners (Mr. W. Haywood, M.Inst.C.E.); and at their meeting on the 24th of October last, he laid before them a description of the well, which was ordered to be printed and circulated. We have received from Mr. Haywood a print of the document, the principal portions of which are given below.

Before describing the works connected with the sinking of the well, Mr. Haywood gives a history of the undertaking. Early in 1886, some dissatisfaction was expressed at the charges made for water supplied to the citizens of London; and this having been brought under the notice of the Commissioners, they instructed their Solicitor (Mr. E. A. Baylis), on Feb. 23 in that year, to report to them as to their power to take steps "to supply the citizens with water for all purposes under the 147th section of the City of London Sewers Act, 1848." On the 9th of the following month, he reported that the Commissioners had power "to cause any wells to be dug and sunk in such places as they shall think proper, and also to erect and fix any pumps in any public places for the more effectual supply of water to the inhabitants of the City." He further reported: "There is nothing in the Act, however, to enable the Commissioners to acquire compulsorily the sites that would be required for the wells, or the erection of the necessary pumps, nor is there any provision enabling them to take up the public ways, or provide and lay down pipes for the supply of water for private or domestic purposes." The subject was then referred to the Streets Committee for consideration and report; and on the 12th of March, they referred to the Engineer the question of the practicability and the probable cost of sinking a well to supply the artizans' dwellings with water. On the 9th of April, Mr. Haywood reported that there was a piece of vacant land in New Street, Gravel Lane, adjoining the dwellings, which was suitable for sinking a well and erecting the necessary pumps, engines, &c. This report was fully considered by the Committee, who took Counsel's opinion on the subject; and, on Jan. 11, 1887, they brought up a report recommending that, as an experiment, a well should be sunk on the land specified, "with the necessary machinery and appliances for the supply of water for public purposes;" and that the necessary tenders should be advertised for. The Engineer then prepared the necessary drawings and specification for the work; and in due course tenders were submitted for sinking a well to a depth of 350 feet. The prices tendered varied from £1350 to £5826; several of the tenders being for wells of an entirely different character from that described in the specification. On the 7th of June, the Committee submitted the tender of Messrs. Z. Hills and Co., amounting to £1750, to the Commissioners; and this was accepted. The works were commenced on the 2nd of August following; and at first they progressed in a fairly satisfactory manner. As the depth increased, however, difficulties usually encountered in sinking deep wells were met with; and the contractors did not carry on the works so as to ensure their completion within the contract time, or a reasonable period afterwards. After they had been in hand two years, the works were stopped on April 17, 1889—the depth then reached being only 148 feet—and the contract with Messrs. Hills and Co. annulled. Legal and other questions then arose between the contractors and their sureties, which caused further delay. In the end, the Commissioners resolved, on June 18, 1889, to allow the sureties to complete the work—eight months' extension of time being granted them for doing so. Further delay upon various grounds then ensued; but the result eventually was that the sureties never took over the contract or began the work of completing the well. On Oct. 22, 1889, the Committee were authorized to obtain tenders for completing the well, and to accept such as they deemed advisable. They were to take all measures for speedily completing the work. A specification was then prepared by the Engineer; and on Nov. 29, the tender of Messrs. Tilley and Sons, amounting to £1550, was accepted. The contract was signed on Feb. 13, 1890. On the 3rd of March, the work was recommenced, and was diligently and satisfactorily proceeded with until a depth of 172 feet was reached, when a bed of very hard rock, 5 ft. 9 in. in thickness, was encountered, which caused considerable delay. At the end of the year 1890, the depth from the surface was 200 feet; and when it had reached to 227 ft. 8 in., the chalk was touched and boring commenced. On July 29, 1891, the contract depth of 350 feet was reached. The well then yielded only 900 gallons of water per hour—a quantity inadequate for the supply of the dwellings; and, on the advice of the Engineer, the Commissioners, on the 22nd of September, decided to sink the boring another 100 feet. This was completed on the 24th of October; and the well, then 450 feet in depth, was found to yield about 2000 gallons of water per hour. On the 3rd of November, the Engineer reported his opinion that a much larger yield would result if the boring were continued to a greater depth; and the Commissioners then ordered an additional 100 feet to be bored. This was carried on until the borehole reached a depth of 512 ft. 6 in. from the surface. There were then indications in the strata which induced the Engineer to advise that no further sinking should take place. The boring was then permanently stopped. The well was pumped for 72 consecutive hours, and the yield of water found to be about 70,000 gallons in 24 hours, or about 3000 gallons per hour, which was more than three times the quantity needed to supply the dwellings. The sinking of the well occupied from Aug. 2, 1887, to Dec. 30, 1891—a period of about four and a half years; but the difficulties with the first contractor, and the consequent stoppage of the works for so long

a period, were the principal reasons for the work having been so long in hand. After the well was completed, the necessary engine-house was built, pumps and engine were fixed, and the water supply laid on to the dwellings. This work was finished at the end of 1892; and, since the 31st of December of that year, an uninterrupted supply has been afforded to the dwellings. The cost of the work has been as follows: Well sinking, £2378 3s. 6d.; for pumps and mains, gas-engine, erection of well-house, making good pavements, &c., incidental to the work, £2270 9s. 4d.; clerk of works, £961 8s. 6d.—total, £5610 1s. 4d. When the well had reached the depth of 450 feet, Dr. Sedgwick Saunders, the Medical Officer of Health for the City, made an analysis of the water; and on Nov. 17, 1891, he presented a long report stating, *inter alia*, that not a trace of sewerage or other deleterious material existed in the water, and that it might with every confidence be used for all kinds of domestic purposes. Subsequently, when the well was completed to the depth of 512 ft. 6 in., he made a further report, which was mainly to the effect that the sinking of the well had resulted in a copious supply of wholesome water, fit for every purpose of domestic life.

The following is Mr. Haywood's description of the work:—

At the commencement of the excavation from the surface level, and to a depth of about 25 feet therefrom, a shaft 10 feet 10 inches square was sunk. The shaft was strongly timbered as the sinking proceeded, passing through made ground, alluvial soil, and brick earth, into gravel (which was reached at about 17 ft. 8 in.), in which various fragments of shells and lignite were found. After entering the gravel beds, and at a depth of 25 feet from the surface (23 ft. 6 in. above Ordnance datum, and 11 ft. 1 in. above Trinity high water), water was reached. This appears to be the standing level of the water in the gravel bed.

On the completion of the timbering in the shaft, guides for the cast-iron cylinders were fixed to enable them to be lowered, and kept true and vertical during sinking. These cylinders were each 9 ft. 5 in. external diameter, and were cast in four segments, of 1¼-inch metal throughout, and were bolted together. The cylinders had bracketed flanges 4 inches wide at the top, bottom, and sides, with the usual chipping surfaces complete. Each flange had oval holes in it, 8⅜ inches apart, for 1-inch bolts. The cylinders were in 5-feet lengths; the horizontal joints being caulked with 9-strand, hempen-plaited gasket, and the vertical joints with ⅜-inch pine strips. The segments were bolted together with inch bolts; and each cylinder was fitted and joined to the others before it was lowered. The leading or cutting cylinder was ⅛-inch thicker than the others, and had a strengthening rib at about 1 ft. 10 in. from its lower or cutting edge. The weight of this cutting cylinder was 3 tons 15 cwt.

During the sinking of the cylinders through the strata of gravel, pumping had to be resorted to, to enable the excavation to be carried down to the bottom. The gravel changed its character as the work proceeded. At a depth of 22 feet, it was of a coarse and sandy nature; becoming finer and dark stained as it deepened and approached the yellow clay, which it overlaid. After entering the yellow clay, the cylinders partly shut back the surface water. The blue clay was reached at a depth of 32 ft. 7 in., and the column of cylinders, consisting of seven lengths, was sunk into the clay 5 ft. 5½ in.; 12 in. of this depth being driven into the solid clay, and reaching a depth of 38 ft. 1 in. from the surface. At a depth of 33 feet from the surface, a fine example of Septaria was found; and at a few feet lower down, fragments of shells, and portions of fossil plant stems, and again Septaria were found. Water had freely entered the well up to this point; but at the depth named, it had been almost entirely excluded. The joints of the cylinders were then examined, and their verticality tested. The recovery of the timber used in the upper portion of the sinking was made from time to time, and the void spaces at the back of the cylinders, caused by its removal, were filled with fine cement concrete in the proportion of six to one.

The excavation was now carried down into the blue clay, while the steining or brick lining of this portion of the well was commenced. The internal steining was 8 ft. 3½ in. in diameter, and was executed with good stock bricks, set in Portland cement, mixed in the proportion of three parts of cement to one part of sand, in sections of twelve courses each in height, in two half-brick rings. The outer ring was first built; its inside face was rendered in neat cement 1 inch in thickness, and the inner brick ring was then built up against it. The clay was carefully excavated to the necessary depth for each section of brickwork—a shoulder being left to support the brickwork above; and as the brickwork was built up, this shoulder was cut away a section at a time, and the brickwork made good to that previously executed. This system of construction was carried on throughout the entire depth of the blue clay, which was 97 ft. 5 in.

The blue clay was variable in its character (it was sometimes firm and dry, or firm and lumpy, and in the lower portions interspersed with sand veins), especially when nearing the black sand bed, which was found at the bottom of the clay. Various fossils were found in the upper portions, Septaria, with lignite fragments of fossil plant stems. At 45 feet from the surface, a "Claystone," enclosing the shell of a nautilus, was found. In the lower part of the blue clay, Septaria were frequently found, together with fossil-wood, pyrites, pebbles, and lignite. On two occasions water was met with in this strata, the outcome of sand pockets in the clay, which caused a slight falling in of the excavation. This was remedied by the insertion of a perforated galvanized-iron pipe at the back of the brick steining, which was brought through the wall to the inside of the well. The accumulated water behind the steining was then drawn off. These pipes were fitted with plugs.

At a depth of 123 ft. 4 in. from the surface, the brick steining terminated; it then being 6 ft. 8 in. above the bottom of the blue clay. A cast-iron hanging ring, formed of three lap-jointed segments, each bolted together by four ⅞-inch bolts, was then bedded in cement on the flange of the topmost cylinder, and bolted to it by twelve 1-inch bolts 6 inches long. Lugs were cast on this ring, from which six 1¼-inch wrought-iron hanging rods were suspended in 20-feet lengths, or thereabouts. Similar rings were built into the brick steining at depths of 65 ft. 6 in., 95 ft. 1½ in., and 120 ft. 4 in. from the surface. The rods were connected together by hexagonal screw junction-pieces 6 inches long. The last of these rings was within 3 feet of the bottom of the brick steining.

Trial borings were made in advance of the sinking, to ascertain the depth of the different strata; and this was done when the blue clay was nearly gone through, and when, on nearing the black sand which lay beneath the blue clay, the water entering the well rose rapidly to the extent of 20 feet in depth. It was then decided to sink an inner tier of cylinders, each having an external diameter of 7 ft. 5 in. and a depth of 3 feet. These cylinders were cast in one complete casting of 1¼-inch metal, with a strengthening rib midway in each, and flanges, &c., similar to the upper cylinders. The weight of each cylinder was nearly 2 tons. The lower or cutting cylinder was, as before, of stouter metal, and had a cutting edge. Guides were then fixed, and the cylinders being jointed together and lowered into the well, the sinking was again commenced, passing through dark-coloured sand, freely intermixed with pebbles. The cylinders were sunk by "misering;" and they travelled occasionally as much as 3 feet at one time.

The depth of the water in the well being now 29 feet, a diver was employed to trim the sides of the excavation. The cylinders (19 in number) were thenceforward driven by weighting them, and also by vibration. The thickness of this strata of black sand was 16 ft. 11 in.; and in passing through it, pieces of pyrited wood and pyrites were found. The cylinders now entered mottled clay, at a depth of 147 feet from the surface, and were driven into that clay about 15 inches. The further entry of the water into the workings was partly prevented, and the well was pumped out.

At this point the works progressed very slowly; and when the cylinders had passed into the mottled clay, they had reached a depth of 148 ft. 3 in. from the surface. The work was then stopped for several months, owing to the difficulties with the contractors, as already explained. The column of cylinders sunk up to that time was about 58 feet in height. A fresh firm of contractors having been employed, after a lapse of several months, the works were resumed; and an examination by the diver having proved to be satisfactory, it was decided to continue sinking the cylinders. During the discontinuance of the works, it was found that sand had blown in under the cylinders at the bottom of the sinking, and had accumulated to the depth of 4 ft. 9 in., and that the water stood in the well to a depth of about 52 feet. The sinking was now proceeded with by the use of a "grab" worked by a steam-winch. A diver was constantly employed, who made frequent descents to trim round the cutting edge of the lower cylinder, and enable the cylinders to pass through the clays of the Woolwich beds. These terminated at a depth of 168 ft. 11 in. from the surface. In these clay beds various shells were found. At the times when the cylinders showed a tendency to become "earth-bound," hydraulic jacks were used; but very little pressure was generally necessary, as the great weight of the number of cylinders now jointed together caused them generally to travel without extraneous aid. Constant examinations were made to test whether the cylinders were sinking truly perpendicularly; and this was found to be the case. During the time occupied in passing through the Woolwich beds, the water remained constantly in the well.

At 172 feet from the surface, a bed of hard conglomerate rock 5 ft. 9 in. thick was reached. This gave a considerable amount of trouble to pass through. Various means were tried. Among others, a 7-inch chisel was attached to iron bore-rods connected with the machinery above, and holes were punched into the rock in the hope of breaking it up; but from the great length of the rods, and their consequent vibration, the force of the blows was so reduced that, although the work was continued day and night, the progress made was but slow. Charges of gun cotton were also put down and exploded by the diver, with but little result; and finally the water in the well was pumped low enough to allow workmen to descend to the bottom and break up the rock with iron wedges and crowbars, and enable the cylinders again to travel. Passing through this 5 ft. 9 in. depth of conglomerate rock occupied 110 working days. The water was then allowed to rise again, and the sinking of the well continued as before, passing through greensand (in which a few shells and pebbles were found) into a lighter-coloured sand, interspersed very frequently with thin layers of clay. It then entered the geological formation known as the Thanet sand. The descent of the cylinders was still continued by means of the "grab" and the diver, who was employed as before mentioned.

On reaching the finer strata of the Thanet sand, quicker progress was made, as the diver, by the use of a 2-inch flexible hose-pipe flushed round the cutting edge of the bottom cylinder, which enabled the column of cylinders (now about 103 feet high) to be sunk in a satisfactory manner. The thickness of the Thanet sand was 32 ft. 2 in. To test the depth of the sand, a trial boring was made, by using 3-inch iron pipes and a 2½-inch shell borer. This was continued until the chalk was reached; the depth of the trial boring being 29 ft. 6 in. The cylinders having passed the Thanet sand and reached the chalk, a chase was cut into the upper surface of it by punching with a 7-inch chisel—the diver also trimming round the cutting edges of the cylinder. Thus the column of cylinders was sunk and driven an inch or two at a time until it reached a depth of 10 inches in the chalk, when the operations partly shut back the water, which was then baled out to within 2 feet of the bottom of the sinking—thus allowing workmen to descend and work on the surface of the chalk.

The total number of the 7 ft. 5 in. external diameter cylinders was 44; and they represented, when bolted together, one continuous column over 132 feet in height. The Engineer had considerable difficulty in obtaining cylinders which were good castings; and many were rejected by him because they were not perfectly true—an absolute necessity in this class of work.

When all the cylinders had been sunk, the annular space between the iron cylinders and the brick steining was filled in with fine cement concrete, mixed in equal proportions of cement and fine ballast. When a sufficient depth in the chalk had been excavated, another and inner ring of cylinders was put down—completing the excavated portion of the well. These cylinders were sunk into the chalk an additional depth of 2 ft. 8 in. This inner ring constituted a column of three cylinders, each 6 ft. 4 in. in diameter and 5 feet in height. Each of these smaller cylinders was in one casting; and the space between the

inner and outer rings of cylinders, to the height of 12 ft. 4 in., was filled in with fine Portland cement concrete as before. From the lower edge of the inner ring of cylinders, a bed of cement concrete 5 feet thick was then put in—forming the bottom of the well. This concrete was composed of one part of Portland cement to one-and-a-half parts of clean-screened gravel. Through the centre of the concrete was fixed a 16-inch cast-iron guide-pipe 10 feet long, into a boring made to receive it in the chalk below. The top of the bore-pipe stands 12 inches above the surface of the concrete bottom of the well.

The water in the well having then risen to the height of 105 feet above the bottom, it was pumped out by a single-throw pump 9 inches in diameter; and a thorough examination was then made throughout the entire depth of the well. All the joints of the cylinders were also filled up flush with neat Portland cement. The accuracy of the sinking was tested from the surface; and the cylinders were found to be absolutely perpendicular. A boring in the chalk, 12 inches in diameter, was then proceeded with. This was done by the use of the ordinary chisel and shell auger. Good progress was made—the average depth bored daily being about 4 ft. 6 in.

As the boring proceeded, loose flints were found. At a depth of 19 eet from the top of the chalk, a bed 2 ft. 6 in. thick was passed through. This was the thickest of all the beds met with. The chalk varied in its character; being of a soft nature at its upper surface, and gradually becoming harder as the boring deepened.

At a depth of 287 feet from the surface, and 60 feet from the commencement of the chalk, the first fissure occurred. These fissures were not met with frequently until a depth of 400 feet was reached. Numerous flint beds were passed through, as well as many loose and unstratified flints, until the boring reached the depth of 512 ft. 6 in. from the surface, and 284 ft. 10 in. from the surface of the chalk. Having reached this depth, it was found that the chalk became softer; and there were other indications which showed a possibility of some danger of the chalk falling in from the sides of the boring. The Engineer therefore decided to bore no farther, and reported the fact to the Commission. The upper portion of the borehole was then lined for a distance of 24 feet from the concrete bottom of the well with wrought-iron bore-pipes in 10-feet lengths 12 inches in diameter and $\frac{3}{8}$ inch in thickness, having screwed joints and steel nipples.

The total depth of the well is 512 ft. 6 in. from the surface of the ground, which is 48 ft. 6 in. above Ordnance datum, and 36 feet above Trinity high-water mark. The surface or normal level of the water is 74 ft. 8 in. below Ordnance datum, and 62 ft. 3 in. below Trinity high-water mark; and when no pumping is taking place, it is 123 feet from the surface. The depth of water in the well is 103 feet, measured from the surface of the water to the concrete bottom.

The geological formations passed through are as follows:—

	Ft.	In.
Made ground, alluvial soils, and brick earth	17	8
Gravel and sand	14	0
Yellow clay		11
Woolwich and Reading beds—		
London clay	97	5
Black sand with water	16	11
Mottled clay	2	11
Sandy clay	4	0
Firm and hard blue clay, with shells occasionally	3	2
Laminated clay, with shells occasionally	3	8
Mottled clay		6
Laminated clay, with shells occasionally	2	1
Mottled clay	5	8
Pebbles (small size)	3	0
Rock, with pebbles and fossil shells embedded	5	9
Greensand, with pebbles and a few shells	9	2
Light-coloured sand, interspersed with thin layers of blue clay	8	8
Thanet sand	32	2
Chalk, having beds of flints; the most important being 2 ft. 6 in. thick, 19 feet from the top of the chalk	284	10
Total depth	512	6

An engine-house has been erected, which covers the site of the well, the engine, and the pumps. The pumping machinery is driven by an "Otto" gas-engine of 9-horse power nominal. The pumps consist of a triple set of stand-pipe pumps of the usual deep-well type, 6 inches in diameter and 18-inch stroke, with 50 feet of stand-pipe above. The working barrels are of cast iron, lined with gun metal $\frac{1}{4}$ inch thick, all bored and turned to fit each other for their entire length. The linings are flanged at the bottom to fit into recesses so as to be kept in place. The gun-metal seats of the suction-valves are faced with the best oil-dressed leather. The pump-buckets are of the open pattern, made of gun-metal fitted with cup leathers, gun-metal valve-seats, and leather-faced valves. The three barrels are fixed upon one suction-chamber, below which hangs the suction-pipe with a foot-valve supported by two $\frac{3}{4}$-inch bolts from the suction chamber to the foot-valve box. The suction-pipe is 6$\frac{1}{2}$ inches internal diameter and 25 feet long, bolted together in three lengths with $\frac{3}{4}$-inch bolts. The suction chamber is 193 feet from the surface, and is suspended 71 feet below the delivery chamber by four 1-inch diameter bolts, in lengths, connected by screw couplings. The stand-pipes from the pump-barrels to the delivery chamber are 6$\frac{1}{2}$ inches internal diameter, and are in six lengths each, bolted together with $\frac{3}{4}$-inch bolts. The delivery chamber is supported upon two strong cast-iron girders fixed to the iron cylinder-lining of the well, 1 ft. 6 in. above the normal level of the water, and 121 ft. 6 in. from the surface. It is provided with stuffing-boxes with gun-metal glands and bushes properly packed for the pump-rods to work through. Heavy bosses are cast upon the suction and delivery chambers, to receive the ends of the four 1-inch bolts tightened up to carry the whole weight of the pumps, stand-pipes, &c., below the delivery chamber, and prevent any straining of the intermediate joints. The delivery-pipe is 6$\frac{1}{2}$ inches internal diameter, $\frac{3}{4}$-inch thick, in 9-feet lengths, bolted together with $\frac{3}{4}$-inch bolts, and stayed to the girders carrying the guide-roller frames. The air-vessel, placed at the bottom of the delivery-pipe, is of 1-inch metal, 12 inches in internal diameter and 5 feet long. The pump-rods are 1$\frac{1}{4}$ inches in diameter in long lengths, connected by screw couplings, and travel between cast-iron guide-rollers set in frames fixed on cast-iron girders at intervals of 13 ft. 6 in. in height across the well. The top end of the pump-rods are attached by pin joints to forked connecting-rods, which work in guides bushed with gun metal. The connecting-rods are 7 ft. 6 in. long between centres, and 1$\frac{5}{8}$ inches in diameter, working on an equal three-throw crank-shaft. The cranks are 4$\frac{1}{2}$ inches in diameter in the neck and 12 inches apart, centre to centre. The crank-shaft bearings are 4$\frac{1}{2}$ inches in diameter and 7 inches wide, extended at one end to carry a spur-wheel 4 ft. 8 in. diameter and 5 inches wide on the face. A countershaft 2$\frac{3}{4}$ inches in diameter carries a corresponding pinion 14 inches in diameter (the proportion between wheel and pinion being four to one) and a pair of fast-and-loose pulleys, 54 inches in diameter and 6 inches wide, driven by a leather belt from the gas-engine. The crank-shaft, countershaft, gearing, and pulleys are carried in heavy plummer blocks, fixed to strong cast-iron girders, 12 in. by 6 in. laid across the well. The distance from the centre of the countershaft to the centre of the driving-pulley of the engine is about 23 feet. The driving-pulley is 21 inches in diameter, and runs, when in ordinary work, at the rate of 200 revolutions per minute, giving a speed of about 19 revolutions to the crank-shaft, at which rate the pumps yield about 5500 gallons per hour. The water is pumped directly from the delivery-pipe into a 4-inch rising main 57 feet high, having a 5-inch stand-pipe 15 feet high on the top, thence passing by a 4-inch descending main into the service-mains, which are 3 inches and 4 inches in diameter. The 4-inch rising and falling mains are carried up outside the block of buildings nearest the well; and to preserve the water from freezing in them while the pumps are standing in cold weather, they are enclosed in a zinc casing 10 inches in diameter, the annular space intervening being filled up solidly with charcoal. The 4-inch main from the pumps to the ascending main is provided with pressure, reflex, wash-out, and other valves, &c., complete.

The artizans' dwellings served by the new well consist of five blocks of buildings erected between Stoney Lane and Harrow Alley, Houndsditch, and contain 241 separate tenements, and 535 rooms and 36 shops. Each block has five floors. There is a water storeage capacity of 14,366 gallons, by means of 32 tanks provided on the roofs—viz.: On the north block, eight tanks holding 3850 gallons; on Prince's block, six tanks, holding 2662 gallons; on Queen's block, six tanks, holding 2616 gallons; on King's block, six tanks, holding 2616 gallons; and on the south block, six tanks, holding 2622 gallons—total, 14,366 gallons. The service-mains supplying these tanks are cast-iron socketed pipes, lead jointed, and laid 2 ft. 6 in. deep in the soil. They are provided with all necessary valves, stopcocks, wash-outs, and connections to hydrants for surface cleansing and fire hydrants. The supply-pipes from the service-mains to the tanks are of galvanized iron, 1$\frac{1}{2}$ inches in diameter, with stopcocks at the bottom and air-valves at the top, and are the same as were used formerly for the supply from the New River Company's mains, from which they have been disconnected, and are now connected to the Commissioners' new mains with but little alteration. The New River Company's mains have not been otherwise disturbed; and the fire hydrants on their system are available in case of need. Additional fire hydrants have been also provided from the Commissioners' mains.

Appended to the report are the reports by the Medical Officer referred to therein, and three folding plans of the works, showing the strata passed through.

OTTOMAN GAS COMPANY, LIMITED.

The Ordinary Meeting of this Company was held last Tuesday, at the London Offices, 9, Queen Street Place, E.C.—Mr. EDWARD HORNER in the chair.

Mr. T. GUYATT (in the absence of the Secretary, Mr. A. J. King) read the notice calling the meeting; and the Directors' report and the accounts for the half year ending Dec. 31 last, allusion to which was made in the JOURNAL for the 13th inst., were taken as read.

The CHAIRMAN, in moving the adoption of the report, remarked that, notwithstanding the miners' strike, coal had cost the Company £290 less than in the corresponding period of 1892; but they had had a diminution of 108 tons in the quantity carbonized. The gas-rental (which amounted to £8431) showed a decrease of £122, which arose entirely from the private lighting, consequent upon the cholera epidemic. The other items in the revenue account compared favourably with those for the December half of 1892.

Mr. A. J. DOVE seconded the motion, which was carried.

The CHAIRMAN next proposed a resolution, adding £1500 to the reserve fund (making the amount to its credit £5500), and declaring a dividend at the rate of 7 per cent. per annum, free of income-tax, on both classes of shares.

Mr. DOVE having seconded the proposition, it was agreed to.

On the motion of the CHAIRMAN, seconded by Mr. STEPHENSON R. CLARKE, the Directors retiring by rotation (Mr. Dove and Mr. C. Gandon) were re-elected; and on the motion of Mr. S. SIMMELKJÆR, seconded by Mr. W. H. HARDY, F.C.A., the Auditors (Messrs. C. K. Butt and T. Guyatt) were re-appointed.

A vote of thanks having been passed to the various officials,

Mr. H. W. ANDREWS, the Consulting Engineer, responded on their behalf. In doing this, he observed that the carbonizing returns testified to the attention which their Engineer and Manager (Mr. John Gandon) and his staff gave to their work. The Directors were also fortunate in getting their coal contracts settled some time previous to the strike; and to this and the low freights was due to a great extent the present satisfactory position of the Company.

The services of the Directors were suitably acknowledged; and the proceedings then terminated.

Change of Address.—Messrs. J. M'Kelvie and Co., of Edinburgh have changed their London address to 37 and 38, Mark Lane, E.C.

STOURBRIDGE COMMISSIONERS' GAS SUPPLY.

The Gas-Works Purchase Expenses—Reduction in the Price of Gas.

At a Special Meeting of the Stourbridge Town Commissioners yesterday week, Mr. Walter Jones presented the final report of the old Gas Committee. This stated that the total payments already made in respect of the purchase of the gas undertaking amounted to £109,485, and £215 remained to be paid. After these payments, the Board would have made disbursements amounting to £3200 more than the sum already borrowed from the Star Assurance Society. The Committee recommended the Board to borrow the latter amount from that Society at 4 per cent., repayable in forty years. As there was a variation from the contract of December between the Society and the Board, the Society asked for, and it was agreed to give them, a return of the Board's right to ask for a further sum. Doubtless some member would inquire what the undertaking had cost the Board. The simple answer was £115,200. This was made up of the following sums: Awarded price for gas-works, £99,800; debentures, £5500; contracts for new works, £5802 4s. 2d.; stamp duty on conveyance, £670 14s.; Gas Company's costs paid by the Commissioners, £726 15s. 5d.; arbitrators' and umpire's fees, £501 16s.; negotiation fee and solicitors of lender, £466 8s. 4d.; Commissioners' expenses, £1722 2s. 1d. (which included Counsel, £372 7s.; engineers, £408 2s.; accountants, £132 7s. 10d.; clerk, £500; London agents, £64 5s. 1d.; law stationers and printing, £66 19s. 9d.; arbitration expenses, witnesses, shorthand writers, &c., £118; incidentals, £60 0s. 5d.—total, £115,200. The report was adopted; and the original Committee was then formally dissolved. The working Gas Committee reported that they had been considering the expediency of making a reduction in the price of gas to all consumers. They had no reserve fund, neither had they any surplus capital to cover an adverse contingency, and there was some uncertainty whether they would be able to make contracts for the future supply of coal at the existing rates. Nevertheless they were anxious to afford every possible facility for an increase in the consumption of gas; and believing that a low price would be the greatest incentive to that, the Committee had resolved to reduce the price 3d. per 1000 cubic feet to all consumers, as from the end of the present quarter. After a short discussion, the recommendation was adopted.

GERMAN CONTINENTAL GAS COMPANY.

Report and Accounts for 1893.

We have received, through the customary courtesy of Herr W. von Oechelhaeuser, the General Director of the above Company, a copy of the annual report of the Directors and the balance-sheet for last year.

The results of the year's working were eminently satisfactory, notwithstanding the continued general depression. The total gas production amounted to 38,200,435 cubic metres (1,349,110,000 cubic feet); being an increase on that of the preceding year of 4·97 per cent., against a corresponding increase of 3·10 per cent. in 1892. The number of burners in use was larger by 6·48 per cent. during the past year; making the greatest annual addition to their number since the foundation of the Company in 1856. The increased consumption, the lower price of coal, and the rise in value of the rouble, have co-operated to provide a better financial result than that of the preceding year, though the sales of coke and ammonia have been but little more productive, and the price of tar has fallen considerably. The increased production of gas is the more remarkable, in view of three important causes of diminished consumption—viz., the establishment of Sunday rest, the adoption of South Europe standard time, and the introduction of the incandescent system of lighting. The alteration of the time standard has affected all the stations of the Company, but especially those in Thuringia, where evening labour has been shortened by 16 or 17 minutes, and the industrial district of Gladbach-Rheydt, where the working time is more than half an hour earlier than formerly.

The falling off due to the introduction of the incandescent gas-light was felt for the first time through a whole year; moreover, the number of these burners increased from 8067 to 12,929. Assuming the economy effected by the use of this light to be only 50 per cent.—a moderate estimate—the falling off in consumption due to its introduction would amount to 1·8 per cent. of the total gas consumption in 1892. Notwithstanding this, the gas consumed for lighting purposes in 1893 shows an increase of 2·3 per cent. on the similar amount in 1892. This bears out the prediction of last year's report that the extension of gas lighting to other districts and to new customers would more than counteract the diminution in consumption due to the adoption of the incandescent system. The use of the Welsbach light for street illumination is at present restricted to a few streets and squares, pending the introduction of larger burners. It is now firmly established that the light gives a duty from five to eight times greater than that of the old slit burners for the same gas consumption.

The position of the gas industry with regard to the electric light is as firm as hitherto, and is even strengthened by the incandescent gas-light. In the previous report, allusion was made to the new and extensive use of gas opened up by the application of gas-engines to the propulsion of tramcars. The Company have aided the formation of the Dessau Tramway Company, by taking shares therein to the value of £2500, and by providing gas-compressors. The first stretch of 2½ miles will come into operation during this year, and be worked by nine cars fitted with gas-motors on the Luhrig system.

Herr Oechelhaeuser visited the United States during the past year, for the purpose of gaining practical acquaintance with the methods of water-gas manufacture there adopted. He does not hold out any hope of the profitable production of water gas for illuminating purposes in Germany at the present time; and if, in the future conditions should become more favourable to it, American practice points to the advantage of admixing coal gas, so that the works erected for making the latter would still be utilized.

Turning to the statistics of the several stations of the Company, we find that at only three out of the thirteen has the production of gas fallen off since the preceding year; and the decrease in these cases is almost inappreciable. The largest station—that of Warsaw—shows an augmented production of 8·69 per cent. as compared with 1892. At all the towns supplied, the number of burners in use is greater than in the preceding year. The quantity of gas delivered to public buildings is slightly less; but for every other purpose the supply has risen. The most noteworthy figures are an increase of 22·56 per cent. in the gas used for purposes of motive power, and of 18·87 per cent. in that employed for cooking and heating. Private houses consume for illuminating purposes 36 per cent. of the total production of the Company. Upward of 13 miles of mains were added to the Company's distributing system during the past year. The average price paid for coal for gas making was about 19s. 3d. per ton; Westphalian, English, and Silesian being the chief varieties used. The average make of gas per ton of coal was 10,675 cubic feet. The coke and tar used for firing the retort-furnaces amounted to 16·5 per cent. by weight of the coal carbonized. The electric lighting station at Dessau, belonging to the Company, supplied less light than in 1892; but the cost of its production was somewhat lower.

The accounts for the past year show a gross profit of 2,544,129·61 marks (about £125,000 at the present rate of exchange); being an increase of 286,336·69 marks over that of the preceding year. The net profit on the year's working is 1,948,044·86 marks, of which a sum of 356,324·18 marks is apportioned to the various reserve and contingency funds; the remainder serving for the payment of the dividend at the customary rate of 10 per cent.

METROPOLIS WATER SUPPLY.

The London County Council and the Metropolitan Water Companies.

At the Meeting of the London County Council last Tuesday, the Water Committee reported as follows on the steps they had taken in regard to the acquisition of the undertakings of the London Water Companies:—

We communicated in due course to all the Metropolitan Water Companies the resolution of the Council, passed on the 27th of February last, with regard to entering into negotiations for the purchase of the Companies' undertakings. At the same time we intimated that we should be glad if, when the Directors of each Company had considered the terms of the resolution, they would be good enough to inform us whether they would enter into negotiations for the sale of their undertakings on the basis therein indicated. We have received simple acknowledgments from the Secretaries of the Lambeth and New River Water Companies; but three other Companies—viz., the Grand Junction, the Southwark and Vauxhall, and the East London—have returned specific answers. The Grand Junction Company state that they are not willing to enter into negotiations at the present moment for the sale of their undertaking to the Council; the Southwark and Vauxhall Company say that they have no intention or desire whatever to sell their undertaking; and the East London Company do not see their way to enter into negotiations for sale on the basis indicated in the resolution, but they add that, if any definite and practicable proposals are made for the purchase of their undertaking, they will be prepared to give them careful consideration. In view of the receipt of these letters, we have had to consider what further steps we could advise the Council to take at the present time. We do not propose any immediate steps with regard to the Grand Junction Company; but it appears to us that the promotion of Bills by the Southwark and Vauxhall, East London, and West Middlesex Companies is a circumstance requiring the immediate attention of the Council. The Council has already resolved to present petitions against these Bills; and the draft petitions are now under consideration by the Parliamentary Committee in conference with us. We think, however, that the Council should not rest satisfied with this, but should take action to obtain the rejection of the Bills altogether. The inevitable result of their being carried would be to increase the vested property of the Companies, and to add to the difficulties in the way of the attainment of the Council's objects. We therefore recommend—"That the Council do request those of its members who are also members of Parliament to oppose the Bill of the Southwark and Vauxhall Water Company on second reading, and to take all possible steps to ensure its rejection; and that a similar course be adopted with regard to the Bill of the East London Water Company." The West Middlesex Company has not as yet replied to the Council's letter; but that Company is applying to Parliament for powers to raise £500,000 additional capital without specifically stating to what purposes it is to be applied. We think, therefore, that the Council will be justified in taking steps to secure the rejection of this Company's Bill also; and we recommend—"That the same course be adopted with regard to the Bill of the West Middlesex Water Company as recommended in the other two cases."

Mr. Boulnois, M.P., held that the recommendations of the Committee might, if adopted by the Council, mean that they would prevent employment being given to thousands of working men. This selfish policy of the Council in the matter was somewhat on all-fours with their proceedings about betterment. They would not make any improvement in London, and they would not do anything for the working classes in the way of giving them work, because they could not get betterment; and, in the same way, they would not allow the Water Companies, if they could prevent it, to get capital for what might turn out to be absolutely necessary work for the health of London, because they could not acquire the Companies' undertakings on their own terms and their own conditions. He did not think this was a course the Council ought to take.

Mr. Beachcroft challenged the Chairman of the Committee to say that he had taken care to test the feelings of the people concerned in this matter. If he had, he would have found a unanimous feeling in favour of the Companies having powers given to them to carry out their works.

The Vice-Chairman (Mr. Harrison) stated that there were interchangeable powers of sale between the Companies of the water drawn from the Thames. But the Companies who wanted more water would not buy, because the cost would come out of income; and the

Companies who had a surplus would not sell, and would not give the water gratuitously.

Mr. BASSETT-HOPKINS (Chairman of the Committee) argued that the powers asked for by the Companies were not necessary, as the Council were themselves looking out for future water supplies. There was no possible solution that would be satisfactory to the interests of the Metropolis except absolutely opposing these Bills on second reading.

The recommendations of the Committee were then adopted.

The Quality of the Water during February.

The returns furnished to the Registrar-General by the London Water Companies as to the water supply of the Metropolis during the past month, show that the average daily supply was 187,920,100 gallons, as compared with 182,253,249 gallons in the corresponding month of 1893. The number of services being 801,971, the rate was 234 gallons to each service. Of the entire bulk of water sent out, 95,788,117 gallons were drawn from the Thames, and 92,131,983 gallons from the Lea and other sources. Reporting upon the quality of the supply, Dr. E. Frankland said: Taking the average amount of organic impurity in a given volume of the Kent Company's water during the nine years ending December, 1876, as unity, the proportional amount contained in an equal volume of water supplied by each of the Metropolitan Water Companies was: Kent, 0·7; Tottenham, 1·4; East London (deep well), 1·8; New River, 2·4; Colne Valley, 2·5; East London (river supply), 4; Grand Junction, 4·8; Lambeth, 4·9; Chelsea, 5; Southwark, 5·3; and West Middlesex, 5·5. The unfiltered river waters contained the following proportions: New River Cut, 2·4; East London intake, 3; and Thames at Hampton, 4·7. The Thames at Hampton was, on the 12th of February, turbid and yellow. It was, both chemically and bacterially, of very much better quality than on the 15th of January, when my previous sample was taken. Chemically, indeed, it was, as is seen from the foregoing comparison, of even better quality than the water delivered by any of the five Companies drawing from this river, although bacterially, of course, enormously inferior. It was efficiently filtered before delivery; and it exhibited the following percentage bacterial improvement: Chelsea, 99·89; West Middlesex, 99·83; Southwark, (No. 4 filter) 99·94, (No. 8 filter) 96·55; Grand Junction, (Hampton general well) 97·35, (Kew general well) 99·37, (Kew south well) 99·60; Lambeth, 99·37. The New River Cut was, on the 14th of February, turbid and pale yellow in colour. It was, both chemically and bacterially, of very much better quality than on the 17th and 29th of January, when my last samples were taken. It was efficiently filtered before delivery; and was improved, bacterially, to the extent of 99·31 per cent. The crude river water of the Lea, at the East London Company's intake at Angel Road, was turbid and pale yellow in colour. It was, both chemically and bacterially, of enormously better quality than on the 18th of January, when my last sample was taken. It was efficiently filtered before delivery, and improved bacterially, on the average, 99 per cent. As in the case of the Thames water, the supplies derived both by the New River and East London Companies from the Lea were inferior in chemical quality, as regards dissolved constituents, to the raw river waters, owing, no doubt, to the circumstance that the water abstracted from the respective rivers on previous days was of much worse quality than that which was passing down these streams on the days when the samples of raw and filtered water were collected. The deep-well waters of the Kent, Tottenham, and East London Companies were of excellent quality for dietetic purposes; but the Colne Valley Company's water, though better than nearly all the river waters, contained for deep-well water, an abnormal, though small, amount of organic matter of vegetable origin. All these waters were clear and bright without filtration; and the Colne Valley Company's water was softened before delivery, and thus rendered suitable for washing. The Kent Company's water was again distinguished for its high degree of organic and bacterial purity. Seen through a stratum 2 feet deep, the Kent, Tottenham, and East London (deep-well) waters were clear and colourless; the Colne Valley, clear and nearly colourless; the New River, clear and very pale yellow; and the rest of the waters, clear and pale yellow. The bacterioscopic examination of the raw river waters, and of those supplied by the various Companies, collected on the 12th, 13th, 14th, and 24th of February, gave the results contained in the following table:—

Description.	No. of Microbes per Cubic Centimetre.	Temperature in Deg. C.
Raw River Waters.		
Thames at Hampton	6947	6·9
New River Cut	1395	5·2
New River Company's unfiltered water after passing through reservoirs.	1053	6·2
Lea at Angel Road	8947	5·7
„ after storeage	1079	5·3
Thames.		
Chelsea	8	6·0
West Middlesex	12	6·3
Southwark, No. 4 Filter	4	7·3
„ No. 8 „	240	7·1
Grand Junction, Hampton general well	184	7·0
„ Kew general well	44	6·5
„ Kew south well	28	6·8
Lambeth	44	7·3
Lea.		
New River	4	6·0
East London, No. 1 Essex well	128	5·7
„ No. 12 bed	52	5·3
Deep Well.		
Kent	6	11·4

In the course of their report for the past month to the Official Water Examiner (Major-General A. de Courcy Scott, R.E.), Messrs. Crookes and Odling say: "Of the 168 samples examined, four were clear but dull, and all the rest clear and bright. Again we have to record a deficient rainfall, which at Oxford has only been 1·6, instead of 2·92 inches, the average of 25 years. It will be remembered that the month of February last year was one of the few months in which the rainfall was in excess of the average. The tables show a slight change in the Thames-derived waters in respect of the colour and quality of the small proportion of organic matter present. This will be best seen by putting the results of the last few months in a tabular form:—

	Ratio of Brown to Blue Tint.			Ratio of Organic Nitrogen to Organic Carbon.		
	Brown.		Blue.	Org. Nit.		Org. Car.
1893, November	15·5	:	20	30·3	:	100
December	19·4	:	20	26·6	:	100
1894, January	24·2	:	20	24·5	:	100
February	23·3	:	20	18·3	:	100
1893, February	23·6	:	20	20·3	:	100

Note.—All the figures are means.

With the accumulation of vegetable matter, dead leaves, &c., last autumn, the peaty brown matter in the waters somewhat increased rising to a maximum in January last, and now again declining. Simultaneously, the organic carbon has increased a little, while the organic nitrogen has remained practically the same. A comparison of the ratios of organic nitrogen to organic carbon, calling the latter 100, is very instructive in connection with the variation in colour. While the ratio of nitrogen to carbon, even in November, was low, showing that the vegetable constituents of the organic matter present were in excess, it is seen that this ratio has been continuously decreasing, until last month it was only as 18·3 to 100; showing a prepondering amount of harmless vegetable matter in the minute quantity of total organic matter present in the waters. The winter character of the supply has not been strongly marked during any of the recent months; and it even seems as if the high standard of summer purity would soon be reached. A few weeks of sharp frost, with snow and fogs, are, however, not outside the probabilities of our climate; and with the advent of such wintry conditions, a change from the summer to the winter quality of the water supply would doubtless take place."

THE LARGE WATER SCHEME FOR SHREWSBURY.

An Appeal to the Ratepayers.

The Stretton Hills water scheme has been the subject of another prolonged discussion in the Shrewsbury Town Council. It arose on a recommendation by the Special Committee appointed to consider the matter that a statement of facts relating to the project which had been prepared should be circulated among the owners and ratepayers, accompanied by a voting-paper. The principal portion of the statement referred to was as follows: "The question of an improved supply of water to the town has long engaged the attention of the Council; and before resolving on so large an expenditure, they desire to ascertain the wishes of the owners and ratepayers on the Stretton Hills scheme. The supply will be derived from the Carding Mill and All Stretton Valley by a tunnel, and the water from both valleys stored in a reservoir a little above the village of All Stretton. From this reservoir, it will be taken in iron pipes to a service reservoir on Bayston Hill; and, after passing through filter-beds, be carried on to the town in iron pipes. The reservoir at All Stretton will contain (in addition to the water necessary for compensation to the mills and riparian owners lower down the stream) a sufficient quantity of water to supply the town, at its present population, for about 200 days at 25 gallons per head per day. The present consumption of water is 45 gallons per head per day; so that the waste now taking place must be checked at a considerable cost, and the consumption reduced to 25 gallons, as the supply contained in the reservoir will otherwise be insufficient. The estimated cost of this scheme (exclusive of the greater part of the expense of stopping the waste, which will fall on the owners of houses) is £112,000; but it is proposed to take powers to borrow £120,000. The sum of £120,000 will have to be raised by loan; and if borrowed at 3 per cent., repayable in 60 years, the annual expenditure will be £7720. For this a rate of 1s. 8¾d. in the pound will be required. The present rate is 1s. 2¼d. in the pound. The scheme, therefore, necessitates an increase in the rate of 6½d. in the pound. In 22 years the debt on the present water-works, costing £1930 per annum, will be paid off; and this will allow of the reduction of the water-rate by 5¼d. in the pound—making the rate after that time under the Stretton Hills scheme 1s. 3¼d. in the pound. Ratepayers should distinctly understand that the Council submit this scheme to them as a possible one for supplying the town with water, and believe it would be satisfactory in every way, if they are willing to bear the heavy and uncertain cost. The Council wish it to be recognized, however, that there are undoubtedly other schemes which would in all probability be carried out at a much less cost, and which would afford water, if not actually equal to Stretton, at any rate as good as that supplied to most towns, and recommended by experts as sufficiently safe and pure water. But before making investigations, the Council wish to carry out the following resolution passed at their meeting held on Dec. 11, 1893: 'This Council, considering the enormous cost of the Church Stretton water scheme and the uncertainty of carrying it out for the estimate, cannot advise its adoption by the borough. But, before finally deciding against it, they desire to have an expression of opinion from the owners and ratepayers, and, for this purpose, appoint a Committee of eight to record this opinion, and to draw up a statement of the facts to be sent to each owner and ratepayer, with a voting-paper.'" The Council, therefore, submit the following question to the owners and ratepayers: "Are you in favour of the Stretton scheme, at a probable cost of £120,000, and an increase in the rate of 6½d. in the pound?" The adoption of the report was moved by the Mayor (Mr. W. Browne), and seconded by Mr. Jones. In a speech of considerable length, Mr. Barker strongly supported the scheme. He remarked that the Borough Surveyor's report had been verified by Mr. G. F. Deacon, who was so confident of the accuracy of the estimates that he had stated that he himself could undertake the work for the money. The speaker held that the scheme was a cheap one, and worthy of the old town of Shrewsbury. Mr. Evans, in opposition to the scheme, also dealt with its financial side; but he had no

doubt the cost would run up to £200,000 before it was done with. Alderman Butler-Lloyd thought the first important point to be considered was, Would there be water enough for the town? They were told that there was sufficient to give everyone 25 gallons per day, according to the present population, if the waste were now reduced, but not without; and to reduce the waste would involve a considerable cost—probably £20,000. Then it was a fact beyond dispute that, if they took a certain amount of water above 25 gallons, they would have every riparian owner against them. The next important point was as to the cost. He (Alderman Lloyd) could not discover a single instance where a scheme had been carried out for the money estimated; but he could find 30 cases where the cost had been exceeded. In further discussion, it was pointed out by Sir R. D. Green-Price, with regard to the statement that £20,000 would be required to stop the waste of water now going on, that £5000 to £7000 would probably cover the portion of the cost which the Corporation would have to bear. Alderman Peele also believed that the scheme could not be carried out for the sum named by the Committee. On the report being put to the vote, it was unanimously adopted. The members then turned their attention to the consideration of the question of the extravagant waste of water in the borough; and the Water Committee were requested to report to the Council as to the best means of stopping it.

STEYNING WATER COMPANY'S PROVISIONAL ORDER.

Major Marindin has recently held an inquiry at Shoreham, on behalf of the Board of Trade, respecting the application made by the Steyning Water Company for a Provisional Order to obtain water from the Shoreham and District Water Company's works. Mr. F. T. Pearson, who represented the promoters, opened the proceedings by pointing out the necessity which existed for a proper supply of water at Steyning. There were about 1800 inhabitants; but the place was not extensive enough to support independent water-works. The Shoreham Company could easily supply Steyning without jeopardizing the supply of their present district. The original capital of the latter Company was £7500 in 750 ordinary shares of £10 each fully paid up, and £16,000 additional capital, authorized by a Provisional Order, of which only £8000 had been called up in 800 preference shares (£10 fully paid up), bearing interest at 5 per cent. There was, in addition, debenture capital of £3750, bearing interest at 4 per cent. The Company had two reservoirs at Shoreham and one at Portslade, of a total capacity of 250,000 gallons; and if they took the district at present supplied as having a population of 10,000, and the consumption per head at 20 gallons per diem, that gave a reservoir capacity of one-and-a-quarter day's consumption. As regarded the pumping capacity, the two present engines were capable of dealing with 40,000 gallons an hour; and they had on order engines capable of pumping 60,000 gallons. Regarding the spring, he thought it would be freely admitted that it was practically inexhaustible. Mr. C. O. Blaber, Assoc.Inst.C.E., the Engineer to the promoters, was called, and stated that they had plenty of water at Steyning; but he considered it was inexpedient to establish a pumping-station there. As to the Shoreham Company's supply, he had ascertained by gauging that 2¼ million gallons of water were daily running to waste over the weir last month; and he estimated that almost as much more was wasted daily by percolation. Mr. W. B. Bryan, the Engineer of the East London Water Company, confirmed the last witness's evidence, and added that the relative proportion of the reservoir capacity to the supply of the Shoreham Company was greater than most water companies in England could boast of. The only opposition emanated from the Steyning Rural Sanitary Authority and the Shoreham Local Board, for whom Mr. Cripps appeared. He said it was the wish of the former body that a clause should be inserted in the Provisional Order to the effect that, should the undertaking not be carried out within three years, it should lapse. He remarked that they did not want a latent monopoly which might face them afterwards when they desired to erect works of their own, provided the subject of the inquiry fell through. The Chairman of the Sanitary Authority (Mr. W. Dudney) stated that the supply of water at Portslade was very erratic; but he would not say that, by furnishing Steyning with water, the supply of Portslade would be jeopardized. At the close of the inquiry, Major Marindin visited the Shoreham Company's works.

Deal and Walmer Gas Company.—The half-yearly statement o accounts of this Company has just been issued, and shows the concern to be in a very satisfactory condition. During the six months the revenue amounted to £6210; and the expenditure incurred, to £4655—leaving a balance of £1555. There has been an increase in the revenue, as compared with the corresponding period of 1893, of £220. The expenditure is £293 higher; but this is accounted for principally by the larger amount paid for repairs and maintenance of the works.

The Oldham Electric Lighting Installation.—The Oldham Corporation electric lighting scheme has been completed; and the electric current has been supplied to consumers during the past fortnight. The Provisional Order, under which the works have been constructed, was obtained in 1890. The scheme was drawn up by Professor Kennedy; and in 1892 the Local Government Board approved of it, and sanctioned the borrowing of £27,000 for the purpose of carrying it out. The plant already provided is sufficient for the simultaneous lighting of about 2500 glow lamps of 8-candle power each; and the total cost of the scheme has been £25,070.

New Water-Works for Southminster.—The inhabitants of Southminster are now in possession of new water-works which will meet their requirements for some time. The supply is drawn from a spring at Asheldham, a village a mile and a quarter distant. Here is constructed a brick reservoir capable of holding 13,000 gallons, from which the water is pumped into a wrought-iron circular tank, to contain 15,000 gallons, supported on a brick tower 50 feet high. The cost of the works has been about £2000. The amount borrowed from the Local Government Board was £2200, repayable in 30 years, for which a rate of 1s. 4d. in the pound has been made.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

On Monday, the Edinburgh and Leith Gas Commissioners held their statutory annual meeting, at which there was no business to transact other than the ordinary monthly matters. In the absence of statutory business, Mr. Kinloch Anderson, in a verbal report, said he thought they might congratulate themselves that the past year had been a very satisfactory one. Their manufacture of gas had kept up, and they had obtained a better price for residuals; so that, without anticipating the balance-sheet, which would not be ready for some time yet, they hoped it would be on the favourable side. The reports by the Engineers showed that the output of gas from the Edinburgh works during February was 100,818,000 cubic feet, and from the Leith works 49,987,000 cubic feet; and that on both works there was an increase of 7,349,000 cubic feet over the output the corresponding month of last year. It was resolved to make the offer to the Portobello Corporation to sell gas to them in bulk at the same price as it is sold to ordinary consumers; the Corporation of Portobello to bear the cost of laying a main from the Edinburgh works to Portobello, and the gas to be measured at the works. The Commissioners, on the motion of Bailie Archibald, adopted a resolution dealing with coal contracts, very much less formidable than what was threatened last month, when it was proposed that there should be no strike clauses in contracts. What has now been resolved upon is that a clause be inserted providing that, in the event of a strike or lock-out occurring, the contractor should be bound to supply coal to the Commissioners in preference to outside customers, so long as a supply of coal was on the pithead. It was also proposed that each contractor should be bound to keep in stock a quantity of coal equal to 200 tons for every 1000 tons contracted for; but Bailie Archibald said he was told that the latter provision might lead to an increase in the price of all their coal by perhaps 3d. per ton, and he was prepared to drop it. Notice of motion was given, to the effect that all contractors should be required to pay standard wages. In the evening, the Commissioners held their annual dinner in the Central Hotel. Lord Provost Russell presided over a company of about 60. The room was lighted by means of incandescent gas-lamps, to which reference was made in the course of the evening.

The Corporation of Glasgow have now in operation, at their Dawsholm works, an experimental carburetting water-gas plant. It is reported that the plant is capable of producing 200,000 cubic feet of gas in twelve hours. On Tuesday, the Gas Committee of the Corporation visited the works, and inspected the plant, with which they were satisfied. They travelled from Hyndland in a special train drawn by one of their own locomotives. The Temple Farm works, which adjoin the Dawsholm works, were also visited.

Mr. W. Arnot, the Electrical Engineer to the Glasgow Corporation, delivered a lecture on the Corporation electric light supply to the members of the Institution of Engineers and Shipbuilders in Scotland, in Glasgow, on Tuesday night. The lecture was noteworthy specially in that it gave Mr. Arnot an opportunity of stating that, in his opinion, faults in the electric mains were due to careless workmen. It is satisfactory to learn that Mr. Arnot does not blame gas leakages for disturbances in the mains. He also stated that there were now 382 consumers, who had applied for current equal to 15,487 ampères, which represented roughly 46,460 8-candle power 33-watt lamps, distributed somewhat as follows: 242 shops, 7776 ampères; 21 warehouses, 2680 ampères; 91 offices, 3269 ampères; 3 churches, 229 ampères; 12 private houses, 275 ampères; and 13 clubs, hotels, and theatres, 1258 ampères. They had not had a year's run at the station yet; and it was therefore impossible to give figures as to cost of production. A discussion followed the lecture, which shows how divergent are the views of electricians upon their own business. Mr. Henry A. Mavor held that the scheme adopted by the Corporation was a gigantic blunder; on the other hand, Professor Jamieson championed the system. The discussion was adjourned for a month; and a lively night is expected when it is resumed.

Last Saturday a new gasholder was brought into use by the Irvine Gas Company; the ceremony of turning on the gas being performed by Mrs. Paterson, wife of ex-Provost Paterson, the Chairman of the Company. Messrs. R. and J. Dempster, of Manchester, erected the gasholder, which is of 86,000 cubic feet capacity, and has cost about £3000. At a banquet which followed the ceremony, the interesting information was given that gas was first turned on in Irvine on Sept. 29, 1829, on which occasion there was a holiday in the town, and a balloon was sent up from the gas-works. The only holder the Company then possessed was of 5000 cubic feet capacity. The present annual output is 20 million cubic feet.

It is a singular commentary upon the nebulosity which characterizes the minds of public men when they affect to do things which their training has not fitted them for, that the other week it was reported that the Corporation of Aberdeen had placed the arc lamps in their streets at a greater distance from each other than is customary, in the expectation that the white granite fronts of the buildings would make up, by reflection, for the lack of light; and that it is now found that the very opposite is the effect. The electric lamps throw a glare upon the buildings; but the reflection is so little that a zone exists between the distant lamps which is in almost total darkness. Already one citizen has proposed, in order to get rid of this very glare, that the lamps should be placed in the centre of the street; while another has come forward with the suggestion that they should be placed upon the tops of the present gas-lamp pillars, raised a foot or two, instead of being hung like balloons in mid-air. It is seldom that a community so speedily discovers, or at least admits, the disadvantages of electric lighting; this feeling in Aberdeen is therefore refreshing. I hope to get further refreshment towards the beginning of November, when the annual accounts are made up. That is an element which will appeal with much eloquence to the Aberdonians.

The dispute at Lockerbie over the imposition of a gas contingent guarantee rate has come into the Court of Session, by an action which has been raised by five ratepayers to have it declared that the Gas Commissioners are bound to fix the price of gas at such a rate as will, as nearly as can be estimated, raise sufficient income to meet all costs

of the manufacture and distribution of gas and payment of interest on borrowed money; and that it is illegal to impose the contingent rate. The Commissioners are in the third year of their existence. They are obliged, after the first two years, to annually set apart a sum to the sinking fund; and in that way a deficit of £320 is estimated for this year, to meet which the Commissioners have imposed a rate of 5d. per pound. The argument of the pursuers is that the Commissioners, in estimating their expenditure, are bound to take everything into account; and that it is unfair and unjust to those who do not burn gas to tax them in order that gas may be sold cheaper to those who use it. For the Gas Commissioners, it is contended that they are entitled to levy a rate to meet the interest upon borrowed money; and they also put forward the plea that it is in the best interest of the town that they should assess for that purpose, and thereby be able to reduce the capital of the undertaking, so as to enable them to lower the price of gas. If they are not allowed to do this, they say, the price of gas, which is already 6s. 8d. per 1000 cubic feet, will require to be raised, with the result that fewer people will consume it, and the works may become a dead loss to the town. The case will be an interesting one, as it will settle a point in gas administration which has not yet been decided, because, happily, it has never, to my knowledge, been yet required to impose a contingent rate. The merits of the case cannot be commented upon; but as to its expediency, it is open to say how doubtful it is whether the pursuers have been wise in raising it. Suppose they succeed, what will probably happen is just that the price of gas will be raised, year by year, as the gas consumers drop off, until the works require to be liquidated; and the assessment will then be an eligible imposition. The contention of the pursuers amounts to this, that the Commissioners have no power to impose a rate so long as one gas consumer remains; whilst the Commissioners hold that they have a discretion as to the time when the rate should be imposed. That is the *crux* of the case.

The Stirling Town Council recently held a special meeting in order to consider whether they should go on with their proposed application for a Provisional Order, to enable them to supply electric lighting. They have been driven to take up the subject, as usual, by the lodging of an application for an Order last June by the Caledonian Electric Supply Company. To keep out the Company, the Corporation resolved to themselves apply for an Order; but the peculiar thing then happened that the Company, in their eagerness to snatch the lighting of the town, represented to the Board of Trade that the resolution of the Town Council had been irregularly adopted, in respect that the meeting at which it was carried was not specially called for the purpose. They went further, and represented that the opposition to their proposal came from the gas interest, in which several members of the Corporation were concerned. I do not suppose that this had much influence with the Board of Trade; but the irregularity had, and they directed the Corporation to remove it, if they wished to go on. This was done by the Provost calling the special meeting, giving the statutory notice of its being held. The Corporation on that occasion resolved, by ten votes to eight, not to proceed with their application for an Order. This left the field open for the Caledonian Company. At the meeting of the Council last Monday, a letter was read from the Board of Trade, stating that they proposed proceeding with the application of the Company, and presumed the Council's opposition to the application would be withdrawn. The Clerk was instructed to reply that the Council, before withdrawing their opposition, wished to have an opportunity of making terms with the Caledonian Company; and a Special Committee of the Council was appointed to watch over the matter in the interests of the ratepayers.

Mr. W. Dyack, the Borough Surveyor of Aberdeen, lately delivered a lecture on the "Aberdeen Water Supply" before the Aberdeen Philosophical Society. The lecture was a very instructive one, and dealt with the subject from an historical as well as a scientific point of view. Mr. Dyack said that the first mention they had of a public water supply was in 1632. They now consumed about 70 million gallons of water daily, which was, for domestic purpose, about 50 gallons per head per day. This was an excessive consumption; and efforts were being made, by means of Deacon meters, to reduce it. These efforts had been partially successful. Mr. Dyack then described the new works which the Corporation are about to undertake for purifying the water after it is taken from the River Dee; and he strongly advocated the construction of sand filters. Mr. Bryce, one of the city's representatives in Parliament, was present, and put some questions as to the efficiency of sand filters. These queries Mr. Dyack was able to answer satisfactorily from the report of the Royal Commission on the Metropolitan Water Supply, which one might have expected Mr. Bryce to have been as familiar with as Mr. Dyack himself. The former gentleman went on to express his disappointment that the people of Manchester had been allowed to destroy the beauty of the landscape at Thirlmere by their water-works, instead of being required to beautify a landscape by making a lake for themselves. He would like to know, he said, if the picturesque beauty of the margins of Loch Katrine, which had been destroyed by the raising of the level of the loch in connection with the Glasgow supply, was being recovered. Apparently Mr. Bryce is not a utilitarian, or he would scarcely put a few miles of scenery, in districts where it is to be had in leagues, against the water supplies of such places as Glasgow and Manchester. Mr. Dyack, however, was able to reassure him as to Loch Katrine, where, he said, he believed the margins of the loch were recovering their beauty.

The copious rains which fell in January and February—particularly in the latter month, have set at rest any fears which might have been entertained regarding the water supply of the large towns during the forthcoming summer and autumn. Had rain not come in abundance, and next summer had turned out to be a dry one, the water supplies must have failed in many places, because the gathering-grounds were largely depleted of their moisture. Now all fears on that score have been removed. Mr. J. M. Gale, the Engineer to the Glasgow Corporation Water Department, has calculated that enough rain fell over the Loch Katrine drainage area to supply the city of Glasgow with 60 million gallons of water per day for a whole year. The usual consumption is 50 million gallons daily.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *March* 22.

Sulphate of Ammonia.—The business during the week has not been large; but the market has been fairly strong, and values are well maintained. There has been a rather better home trade; but foreign consumers' orders are conspicuous by their absence, which may now almost be taken as an indication that the requirements to a large extent are covered, at all events as far as the Continent is concerned. The Americans hold inexplicably aloof; and it is impossible to ascertain their intentions. As likely as not, it may end in a sudden rush. There will also no doubt come in yet the usual quick delivery orders from the Continent, as manufacturers there can have bought only just sufficient for orders in hand, and supplies will be required for the extra business. The market closes firm at £14 to £14 2s. 6d. Nitrate has advanced to 10s. 1½d. per cwt.; and so the margin between the two commodities is not as large as it was.

LONDON, *March* 22.

Tar Products.—The market during the week has been somewhat dull and uninteresting. Benzols continue weak and unsaleable. It is surprising, with the present low prices, that gas managers have not commenced to use it for fortifying the gas. It has been clearly shown during the past few months that benzol is nearly three times more effective in increasing the illuminating power of gas than petroleum spirit. It is true that gas will not carry so much benzol as it will of the spirit; but gas of a low illuminating power will carry all that is necessary to increase it to far above any parliamentary standard quality. If the surplus benzol was thus removed from the market, tar would be of better value. There is a little more demand for solvent naphtha; but considerable stocks are known to be held by makers. Creosote and common tar oils are weak, and in competitive value. Tar acids are distinctly firm; but very little new business is reported. A slight spurt in pitch is mentioned; but as most makers are sold, and stocks are low, it does not mean anything. Tar contracts are again reported as being entered into at prices ranging from 13s. to 16s. 6d., according to position; while other products have changed hands at the following values: Pitch, 25s. to 27s. 6d. Benzols, 90's, 1s. 2d.; 50's, 1s. 4d. Creosote, 1¾d. Creosote salts, 25s. Solvent naphtha, 1s. 2d. Toluol, 1s. 6d. Cresol, 1s. 4d. Crude benzol naphtha, 30 per cent., 6¾d. Carbolic acid, 60's, 1s. 8d. Anthracene, 30 per cent., "A," 1s. 1d.; "B," 10d.

Sulphate of Ammonia has changed hands at £14 to £14 2s. 6d., according to port and conditions of sale, which, as far as country ports are concerned, is with 3¼ per cent. discount. The market is firm; stocks are low; and prices look like being maintained. Gas liquor is quoted at 11s. 6d. to 13s. per ton.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The condition generally of the coal trade throughout this district remains very much as reported last week, except that, if anything, the position as regards all descriptions of round coal gradually becomes more and more unsatisfactory. Pits in many cases are not working more than three days, with stocks increasing in quantity, and in some instances already exceptionally heavy for the season of the year. With regard to prices, the tendency continues in a downward direction, notwithstanding the tolerably firm attitude taken by the Lancashire Coal Sales Association, which, judging from the District Committee meetings held during the past week, shows, for the present at least, no disposition to further give way. A number of the leading Lancashire colliery concerns are, however, outside the Association, and are not bound by the official list rates; while round coal in increasing quantities, and at still lower prices, is coming in from Yorkshire, Derbyshire, and Staffordshire, with the necessary result that the position of the Lancashire Coal Sales Association is being steadily weakened, and representatives of collieries who hold firmly to their prices are losing a good deal of business. One or two local inquiries are in the market for gas coal; and it would seem that a favourable opportunity just now presents itself for consumers placing contracts, at least for a portion of their requirements, where they are in a position to put down stocks at once. This, in fact, is the feeling expressed in some well-informed quarters; and it is based upon the fact that, with all descriptions of round coal now hanging upon the hands of colliery owners, and not only going into stock rapidly but accumulating under load, they would probably be disposed to entertain contracts for taking away anything like quantities promptly at very favourable prices—probably more favourable than they might accept later on, when the ordinary contracts for railway and gas coal come upon the market. Quoted prices for round coal are without material change from those given last week. Best Wigan Arley averages about 12s. 6d. to 13s.; Pemberton four-feet and seconds Arley, 11s. to 11s. 6d.; house-fire qualities, 9s. up to 10s., according to quality; while steam and forge coals are obtainable as low as 8s. to 8s. 6d. per ton. For shipment, the official list quotations remain at 9s. to 9s. 6d. for ordinary Lancashire steam coal, delivered at the ports on the Mersey. The present limited supplies of engine fuel meet with a ready sale at full prices, with a slight advance obtainable in some cases. Good ordinary qualities of burgy readily fetch 8s.; best qualities of slack, 6s. 6d. up to 7s.; and ordinary qualities, about 5s. 6d. per ton at the pit mouth.

Northern Coal Trade.—There has been a diminished demand for coal during the last few days; but it is probable that, on the resumption of work after the holidays, there will be an increased demand. Possibly the intention of the miners in some parts of the country to restrict the production of coal will cause buyers to stock a little more freely. Even the restriction spoken of, would meet the needs of the summer; but it might interfere with the stocking of coal for some time. Best Northumbrian steam coal is dull, at 10s. per ton f.o.b.; but some contracts of great importance are being settled over the season at, it is believed, lower prices, which in the course of a few weeks will

begin to be shipped, and will give greater activity to the collieries. Small steam coal is active; and the price is firm at from 4s. 3d. to 4s. 6d. per ton f.o.b. Gas coals are firm in price; but the demand is not very large at the present time, though an increase in the exports must soon be looked for. A contract is now under negotiation for the Rotterdam Gas-Works. This is one of the most keenly contested contracts of the year, because German collieries often take a share. The total quantity is 84,000 tons or thereabouts; and it was last year allotted one-third to Germany and two-thirds to Durham collieries. It is believed that the price of the Durham tenders will be on the basis of about 7s. per ton f.o.b.; but this necessarily depends largely on what is allowed for the freight. For single cargoes of gas coals, the quotation now is from 7s. 3d. to 7s. 9d. per ton f.o.b.; the variation being according to the quality and the position of the pit. Manufacturing coals are steady; larger supplies being taken by some of the shipbuilding yards. Coke for export is very dull; but there is a larger local demand, owing to the increase in the number of blast-furnaces in operation. The price of best Durham coke varies from 13s. 6d. to 14s. 6d. per ton f.o.b. Gas coke is unaltered in price; but the production is now considerably reduced.

Scotch Coal Trade.—The volume of trade remains good, as is shown by the shipping returns; but the character of the business is not satisfactory—being nearly all on short orders, with little prospect of improvement. The only means whereby a forward trade may be fostered, is by a lowering of prices, which would lead to a reduction of the men's wages. This the coalowners are unwilling to face; and so their policy is still a waiting one. Ell coal continues most in demand; and some fair orders for it have been secured. The prices quoted are: Main, 7s. to 7s. 3d.; ell, 8s. to 8s. 3d.; splint, 8s. 3d. to 8s. 6d.; and steam, 9s. to 9s. 6d. per ton f.o.b. Glasgow. The shipments for the week amounted to 135,838 tons—an increase over the quantity in the previous week of 24,723 tons, and over the corresponding week of last year of 8884 tons. For the year to date, the total shipments have been 1,389,611 tons—an increase over the corresponding period of last year of 297,261 tons.

The Electric Lighting Question at Folkestone.—A somewhat heated discussion took place at the Folkestone Town Council meeting last Wednesday afternoon, owing to Mr. Alderman Banks, who is a shareholder in the Gas Company, standing on his rights to take part in the discussion and division on the electric lighting question. "There was evidently," says our district correspondent, a coterie of members who considered that Mr. Banks had no right to vote or speak on the subject, and every time he essayed to address the chair he was howled down in a most disgraceful manner. Eventually the question was referred to a special meeting, and Mr. Banks gave notice that he fully intended to record his vote, and was prepared to defend his position in so doing before the Judges of the land."

Morecambe Electric Light and Power Company.—At the recent ordinary general meeting of this Company, the Secretary (Mr. J. Jowett) made a comparison of the accounts for the past year with those for 1892. He showed that the paid-up capital had increased from £2982 to £5640; the debenture capital, from £1000 to £1500; the Company's assets, from £4317 to £7250; the gross revenue, from £577 to £1281; and the number of lamps fixed, from 1200 to 2400. A dividend of 2 per cent. was recommended; and he explained that the Directors had decided to forego their fees to allow of this being paid. At the request of the Secretary, Mr. Preece made a few remarks, in the course of which he stated that, up to the present, the bulk of the capital had been taken up by outsiders; and he would like to see the public of Morecambe supporting the Company. With regard to the plant, it had been put down on a most economical basis. The report and accounts were approved.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 554.)

Issue.	Share	When ex-Dividend.	Dividend or Div. Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	13 Oct.	10½	Alliance & Dublin 10 p. c.	10	17¼—18¼	..	5 13 6
100,000	10	"	7⅞	Do. 7 p. c.	10	12¼—13¼	..	5 11 1
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	106—108	..	4 12 6
100,000	20	14 Dec.	8	Bahia, Limited	20	10½—11¼	..	13 18 3
200,000	5	15 Nov.	6¼	Bombay, Limited	5	4¾—5	..	6 10 0
40,000	5	"	6¼	Do. New	5	3¾—4	..	6 10 0
380,000	Stck.	28 Feb.	11½	Brentford Consolidated	100	217—222	..	5 3 7
180,000	"	"	8½	Do. New	100	163—168	..	5 1 2
220,000	Stck.	15 Mar.	11½	Brighton & Hove Original	100	205—215*	..	5 6 11
888,500	Stck.	28 Feb.	5	Bristol	100	103—106	..	4 14 4
320,000	20	29 Sept.	11½	British	20	46—48	..	4 13 9
50,000	10	28 Feb.	11½	Bromley, Ordinary 10 p. c.	10	21—22	..	5 4 7
51,510	10	"	8¼	Do. 7 p. c.	10	15½—16½	..	5 3 0
328,750	10	28 July	2	Buenos Ayres (New) Limited	10	5⅜—6⅜	..	3 1 6
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	100—102	+½	5 17 8
150,000	20	28 Feb.	8	Cagliari, Limited	20	26—27	..	5 18 6
550,000	Stck.	13 Oct.	12½	Commercial, Old Stock	100	255—260	..	4 16 2
165,000	"	"	9¼	Do. New do.	100	193—197	..	4 16 5
160,762	"	14 Dec.	4½	Do. 4½ p. c. Deb. do.	100	128—133	..	3 7 9
800,000	Stck.	14 Dec.	13	Continental Union, Limited	100	230—235	..	5 10 7
200,000	"	"	10	Do. 7 p. c. Pref.	100	203—207	..	4 16 7
535,000	Stck.	28 Feb.	5	Crystal Palace Ord. 5 p.c. Stk	100	102—107	..	4 13 5
426,090	10	31 Jan.	10	European, Limited	10	22—23	..	4 6 11
354,060	10	"	10	Do. Partly paid	7½	15½—16½	..	4 10 11
5,646,590	Stck.	14 Feb.	12	Gaslight & Coke, A, Ordinary	100	233—238	..	5 0 10
100,000	"	"	4	Do. B, 4 p. c. max.	100	97—100	..	4 0 0
665,000	"	"	10	Do. C, D, & E, 10 p.c. Pf.	100	273—278	..	3 12 0
30,000	"	"	5	Do. F, 5 p. c. Prf.	100	130—135	..	3 14 1
60,000	"	"	7½	Do. G, 7½ p. c. do.	100	190—195	..	3 16 11
1,300,000	"	"	7	Do. H, 7 p. c. max	100	174—178	..	3 18 7
463,000	"	"	10	Do. J, 10 p. c. Prf.	100	270—275	..	3 12 9
476,000	"	"	6	Do. K, 6 p. c. Prf.	100	163—168	..	3 11 5
1,061,150	"	14 Dec.	4	Do. 4 p. c. Deb. Stk.	100	127—130	..	3 1 6
294,850	"	"	4½	Do. 4½ p. c. do.	100	130—135	..	3 6 8
908,000	"	"	6	Do. 6 p. c. do	100	173—180	..	3 6 8
3,800,000	Stck.	15 Nov.	12	Imperial Continental	100	212—217	..	5 10 7
75,000	5	14 Dec.	6	Malta & Mediterranean, Ltd.	5	4¾—5	..	6 0 0
560,000	100	2 Oct.	5	Met. of Melbourne, 5 p. c. Deb.	100	109—111	..	4 10 1
541,920	20	15 Nov.	5	Monte Video, Limited	20	12¾—13½	..	7 8 2
150,000	5	30 Nov.	8	Oriental, Limited	5	6—6½	..	6 3 1
60,000	5	29 Sept.	7	Ottoman, Limited	5	4—4¼	..	7 15 6
166,870	10	31 Jan.	2	Pará Limited	10	2—2⅜	+¼	8 0 0
				People's Gas of Chicago—				
420,000	100	2 Nov.	6	1st Mtg. Bds.	100	103—109	..	5 10 1
500,000	100	1 Dec.	6	2nd Do.	100	97—102	..	5 17 8
150,000	10	13 Oct.	5	San Paulo, Limited	10	8¼—9½	+½	5 5 3
500,000	Stck.	28 Feb.	15½	South Metropolitan, A Stock	100	313—318	..	4 17 6
1,350,000	"	"	12	Do. B do.	100	255—260	+2	4 12 3
260,000	"	"	13	Do. C do.	100	250—261	..	4 19 7
750,000	"	17 Jan.	5	Do. 5 p. c. Deb. Stk.	100	150—153	..	3 5 4
60,000	Stck.	28 Feb.	11½	Tottenham & Edm'nton, "A"	100	210—215	..	5 7 0
				WATER COMPANIES.				
745,967	Stck.	29 Dec.	10	Chelsea, Ordinary	100	272—277	..	3 12 3
1,720,252	Stck.	13 Oct.	8	East London, Ordinary	100	218—223	..	3 11 9
544,440	"	29 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	147—150	..	3 0 0
700,000	50	14 Dec.	8½	Grand Junction	50	112—116	..	3 13 4
708,000	Stck.	28 Feb.	11½	Kent	100	288—293	..	3 18 6
1,043,800	100	29 Dec.	9½	Lambeth, 10 p. c. max.	100	248—253	−2	3 15 1
406,200	100	"	7½	Do. 7½ p. c. max.	100	200—205	..	3 13 2
310,000	Stck.	29 Sept.	4	Do. 4 p. c. Deb. Stk.	100	130—134	..	2 19 9
500,000	100	14 Feb.	12½	New River, New Shares	100	365—370	..	3 5 6
1,000,000	Stck.	31 Jan.	4	Do. 4 p. c. Deb. Stk	100	133—136	..	2 18 10
902,300	Stck.	14 Dec.	6	S'thwk & V xnall, 10 p. c. max.	100	155—160	..	3 15 0
126,500	100	"	6	Do. D 7½ p. c. do.	100	147—152	..	3 19 0
1,155,066	Stck.	14 Dec.	10	West Middlesex	100	265—270	..	3 14 1

*Ex div.

GWYNNE & BEALE'S PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams: "GWYNNEGRAM LONDON."

GWYNNE & CO.,

TELEPHONE No. 2698.

HYDRAULIC AND GAS ENGINEERS, BROOKE STREET WORKS, HOLBORN, LONDON, E.C.

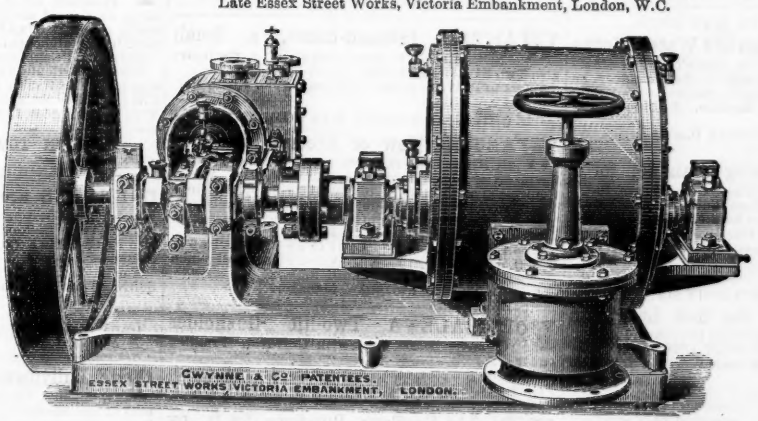
Late Essex Street Works, Victoria Embankment, London, W.C.

Thirty-three Medals at all the Great International Exhibitions have been awarded to GWYNNE & Co., for Gas Exhausters, &c.

They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality.

The result is that in every instance their work is giving the fullest satisfaction.

They have completed Exhausters to the extent of 30,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work, and can be referred to.



Engine and Exhauster Combined on One Bed-Plate.

GWYNNE & Co.'s Exhausters are constructed of large size to pass the required quantity of Gas at very slow speeds; the wear and tear being reduced to a Minimum.

Catalogues and Testimonials sent on Application.

Their Exhausters can be made, when desired, on their New Patent Principle, to pass Gas without the slightest oscillation or variation in pressure.

NO OTHER MAKER CAN DO THIS.

Makers of GAS-VALVES, HYDRAULIC REGULATORS, VACUUM GOVERNORS, STEAM-PUMPS for Tar, Liquor, or Water; PATENT SELF SEALING AND CLEANSING RETORT-LIDS AND MOUTHPIECES; CENTRIFUGAL PUMPS and PUMPING ENGINES specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH-SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not late* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.
Gas Purification and Chemical Company, Limited, Palmerston Buildings, Old Broad Street, London, E.C.
JOHN WM. O'NEILL, Managing Director.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

ANDREW STEPHENSON, Agent. All communications *re* OXIDE to be addressed to PALMERSTON BUILDINGS, E.C.

BRIN'S Oxygen Company, Limited, Westminster. ANDREW STEPHENSON, Agent.

WINKELMANN'S "VOLCANIC" CEMENT. Fire Resistance up to 4500° Fahr. In use in most Continental Gas-Works, and in more than 200 British Gas-Works. [See Advt., p. 506.]
ANDREW STEPHENSON, 182, Gresham House, Old Broad Street, LONDON, E.C. Telegrams: Volcanism, London."

LIQUOR, Tar, and Spent Oxide wanted.
BROTHERTON AND CO., Ammonia and Tar Distillers, BIRMINGHAM, LEEDS, and WAKEFIELD.

GOLD MEDAL, 1892.

TUBES and Fittings for Gas, Steam, and Water, in stock to 8 inches diameter; Iron and Steel Ascension-Pipes.
JOHN SPENCER, Globe Tube Works, WEDNESBURY; and 14, Great St. Thomas Apostle, LONDON.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of SULPHURIC ACID, from Brimstone, for Sulphate of Ammonia making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol. References given to Gas Companies.

CHARTERING, FORWARDING, AND INSURANCE.

ROBERT BRUCE FITZMAURICE, 29, Great St. Helens, London, Shipping Agent to several Gas Companies and Plant Manufacturers, would be glad to UNDERTAKE LARGE or SMALL SHIPMENTS to any Port.

HUTCHINSON BROTHERS, Gas Engineers, &c., Falcon Works, Barnsley, Makers of Wet and Dry Gas-Meters, Brass-Work, and general Gas Apparatus, Lead Saturators, Tanks, &c., Tools, and Gas-Works Sundries. (See last week, p. 542.)
Telegrams: "HUTCHINSON BROS., BARNSLEY."

WANTED, a Situation, as Manager of small Gas-Works. Total abstainer. Age 29. Good references.
Address No. 2359, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TO GAS-STOVE MAKERS.

WANTED, a re-engagement as TRAVELLER. Moderate Salary and Expenses.
Apply, by letter, to No. 2354, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by a Gas Engineer, an Engagement Abroad. Has had eight years' experience in South America as Engineer and Manager.
Apply, by letter, to No. 2355, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TO ENGINEERS AND MANAGERS.

WANTED, by the Son of a Water-Works Engineer, a Situation as ASSISTANT or otherwise, in the Office of a Water-Works Engineer or Manager. Has had four years' experience on Public Works and in General Office Routine. No objection to going abroad.
Address ENGINEER, Water-Works, PORTSMOUTH.

WANTED, a Working Manager for a small Gas-Works. Must be competent to do all-round work, including Mains and Services. Must have held a similar position before. Wages, 30s. per week, with House, Coal, and Gas.
Apply, stating all particulars, to the SECRETARY, Gas-Works, RUGELEY.

TO GAS AND ELECTRIC LIGHT MANAGERS.

THE Directors of the Salt Lake and Ogden Gas and Electric Light Company, Limited, are prepared to receive APPLICATIONS for the post of GENERAL MANAGER at their Works in Salt Lake City, Utah.
Applicants must be Members of The Gas Institute, must have had considerable experience in a Gas-Works of importance, and must be possessed of a practical knowledge of Electric Lighting; both Gas and Electric Lighting being in full operation at Salt Lake City and Ogden.
Applications will be treated as confidential; and a liberal salary will be paid to a really first-class man.
Apply, by letter, with copies of Testimonials, to J. A. KELMAN, Secretary, Salt Lake and Ogden Gas and Electric Light Company, Limited, 251, Winchester House, Old Broad Street, LONDON, E.C.

JAMES LAWRIE & Co. supply Best SCOTCH CANNEL COALS, Best FIRE-CLAY RETORTS, BRICKS, TILES, and LUMPS; BOILER SEATING BLOCKS, FLUE COVERS, and SILICA BRICKS for SPECIAL FURNACE WORK; COKE BARROWS, BOGIES, and SMALL WAGONS.
Postal Address: 1, WHITTINGTON AVENUE, E.C.
Telegram Address: "EIRWAL LONDON."

W. C. HOLMES & CO., Huddersfield; AND 30, CANNON STREET, LONDON,
Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.
*** See Advertisement p. II., centre of JOURNAL.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock Oldham."

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Chemical Works, Leeds, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

PATENTS FOR INVENTIONS.

J. C. CHAPMAN, Chartered Patent Agent, Fel. Inst. Ch. Pat. Agents, Mem. Inst. Mech. Engineers, ADVISES IN ALL MATTERS relating to PATENTS FOR INVENTIONS, TRADE MARKS, &c. Handbook gratis on application.
70, CHANCERY LANE, LONDON, W.C.

SPECIAL PAINT FOR GAS-WORKS.

JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS, MANCHESTER.
Telegrams: "ENAMEL." National Telephone 1759.
GAS PLANT CEMENT
FOR ALL LEAKAGES.

HYDRATED OXIDE OF IRON.

PREPARED from pure Iron
Two or three times as rich as Bog Ore.
Strong action on Sulphuretted Hydrogen.
To be used alone, but will increase activity of other Oxides.
Less than half the price of Bog Ore.
Can be lent on hire.
Write for tabulated results.
READ HOLLIDAY AND SONS, LIMITED, HUDDERSFIELD.

HINCKLEY LOCAL BOARD.
(GAS DEPARTMENT.)

WANTED, a thoroughly practical GAS-FITTER. Permanent job; wages, 30s.
Apply, stating age, experience, whether married or single, and wages required, to G. HELPS, Engineer and Manager.

AGENT WANTED.

ESTABLISHED Firm of Importers would appoint first-class AGENT having strong influence with London Gas Companies. The quality is the finest in the market. Liberal terms.
Address No. 2350, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED (Second-hand), a Small SCRUBBER, to pass about 5000 feet per hour; also Two PURIFIERS, 10 or 12 feet square.
Offers to P. W. BERTLIN, 26, HUNGERFORD ROAD, N.

CHIPPING NORTON GAS COMPANY.

WANTED, New or Second-hand, four PURIFIERS, 8 ft. to 9 ft. square, 3 ft. to 3 ft. 6 in. deep, or, if not square, of a like capacity. Also a Centre-Valve thereto (if on latest principle), or four Four-Way Valves, all 6-inch Connections preferred. The same, if not new, must be practically as good. Quotations (delivered here) are invited.
Also FOR SALE three PURIFIERS 7 ft. 6 in. by 6 ft. by 3 ft. 6 in. deep, with Centre-Valve thereto, all 6-inch Connections, in excellent condition.
Address THOS. BURTONSHAW, Manager.

FOR SALE—A Two-lift Gasholder (Capacity 95,000 feet), with Cast-Iron Framing and Tank.
Address No. 2361, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE—Four Purifiers, 28 ft. by 14 ft., with Covers, 15-inch Centre-Valve, Connections, and Lifting Apparatus complete. Also Two PURIFIERS, 34½ ft. by 16 ft., with Covers, two 15-inch Four-Way Valves, and Connections, complete. Bargains to immediate purchasers. Must be removed in April for extensions. Can now be seen at work.
Apply to R. AND J. DEMPSTER, LIMITED, Newton Heath, MANCHESTER.

IRISH BOG ORE OXIDE OF IRON.

GAS PURIFICATION.

BALE & CO., direct Importers from Ireland. Sample and Price on application.
OXIDE PAINT, SULPHURIC ACID, & Chemicals.
120 and 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE LONDON."

OXIDE OF IRON.

FINEST Quality of Natural Bog Ore. Particulars and price, apply to Mr. T. L. ARCHER, 20, Fennel Street, MANCHESTER.

SADLER AND CO., LIMITED, MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 315, St. Vincent Street, GLASGOW; and 85, Water Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.
Head Office: MIDDLESBROUGH. Correspondence invited.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for, Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings, at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER LINCOLN."

DRAWINGS, Tracings, Specifications, Quantities, Strains, &c., prepared by an experienced Gas-Engineering Draughtsman. Plans of Works made, copied, or enlarged. Illuminated Addresses in first-class style. Writings of all kinds, Engrossments, &c.
Address J. H. OPPENHEIM, 27, FORE STREET, E.C.

ALWAYS a Buyer of Spent Oxide, Tar and AMMONIACAL LIQUOR.
Apply to J. HARDMAN, Milton, STAFFORDSHIRE.

COUNTY BOROUGH OF BOLTON.
(GAS DEPARTMENT.)

TWO STATION METERS ON SALE.

ON SALE—Two Station Meters, one to pass 40,000 cubic feet of Gas per hour, with 16-inch Connections and Valves, made by Braddock, Oldham; the other, to pass 45,000 cubic feet per hour, with 16-inch Connections and Valves, made by the Gas-Meter Company, Limited. The Meters are now in use, are in good condition, and are being removed to make room for Meters of larger capacity.
Further Particulars may be obtained on application to Mr. William Smith, Gas Engineer, Lum Street Gas-Works, Bolton.
Tenders, endorsed "Station Meters," to be addressed to Alderman Miles, Chairman, Gas Committee, Bolton.
March 15, 1894.

THE Directors of the Rochester, Chatham, and Strood Gaslight Company wish to receive TENDERS for the supply and erection of a STATION METER at their Works at Rochester.
Further Particulars on application at the Office of the Company, 58, High Street, Rochester.
WILLIAM SYMS,
Secretary and Engineer.

GODSTONE DISTRICT GAS COMPANY, LIMITED.

TENDERS are invited by the above Company for the supply and delivery, at Godstone Station, of about 1450 yards of 6-inch and 2970 yards of 4-inch CAST-IRON MAINS, and requisite SPECIALS, all coated.
Payment, Prompt Cash on delivery.
Further particulars may be had on application to the Company's ENGINEER (Mr. Robert Fish, Assoc.M.Inst. C.E.), or to the SECRETARY (Mr. E. A. R. Ewen), 5, Great Winchester Street, LONDON, E.C.

BANDON TOWN COMMISSIONERS.

TENDERS FOR RETORTS.

TENDERS are invited for the supply of Nine best machine-made FIRE-CLAY GAS-RETORTS, 9 ft. long by 1 ft. 3 in. inside diameter; also FIRE-BRICKS at per 1000, delivered carriage paid to Bandon.
Tenders to be addressed to the undersigned, and delivered not later than the 31st inst.
J. SHINE,
Manager.
Gas-Works, Bandon,
March 21, 1894.

THE Ballymena and Harryville Gaslight Company, Limited, invite TENDERS for 1700 tons of best Screened GAS COAL, free on Waggon at Larne Harbour, to be delivered before the 1st of November next.
Payment to be made on the first Thursday in March, 1895.
Tenders to be lodged with me on or before Tuesday, the 10th of April.
THOMAS C. C. HOOD,
Secretary
Ballymena, March 22, 1894.

SHEFFIELD UNITED GASLIGHT COMPANY.
NEEPSEND STATION.

TO IRON ROOF CONTRACTORS.

THE Directors of this Company invite TENDERS for the construction and erection of a WROUGHT-IRON HIPPED ROOF, 52 feet long by 43 feet span, over Boiler-House at their Neepsend Station.

Copy of the Drawing and Specification may be obtained upon application to the Engineer (Mr. Fletcher W. Stevenson), on payment of 10s. 6d. (not returnable).

Sealed tenders, endorsed "Tender for Roof," must be delivered to the undersigned (by post), at the Company's Offices, on or before Saturday, the 31st day of March.

The Directors do not bind themselves to accept the lowest or any tender.

HANBURY THOMAS,
General Manager.

Commercial Street, Sheffield,
March 10, 1894.

SHEFFIELD UNITED GASLIGHT COMPANY.
NEEPSEND STATION.

TO BOILER MAKERS.

THE Directors of this Company invite TENDERS for the manufacture and delivery at their Neepsend Works of three LANCASHIRE STEEL BOILERS, each 30 feet long by 7 ft. 6 in. diameter.

Copy of the Drawing and Specification, with Form of Tender, may be obtained upon application to the Engineer (Mr. Fletcher W. Stevenson), on payment of 10s. 6d. (not returnable).

Sealed tenders, endorsed "Tender for Boilers," must be delivered to the undersigned (by post), at the Company's Offices, on or before Saturday, the 31st day of March.

The Directors do not bind themselves to accept the lowest or any Tender.

HANBURY THOMAS,
General Manager.

Commercial Street, Sheffield,
March 10, 1894.

EDINBURGH AND LEITH CORPORATIONS' GAS.

THE Commissioners invite Tenders to supply COAL, LIME, and GENERAL STORES (Pipes, Paint, Timber, &c.), required at their Works in Edinburgh and in Leith during the Year from the 15th of May next.

Tender Forms and all Information can be had on application to the Engineer at either of these Works.

Offers must be lodged not later than Ten o'clock on Wednesday forenoon, the 4th prox., in sealed envelopes, addressed to the undersigned.

The Commissioners are not to be bound to accept the lowest or any tender.

JAMES M'G. JACK,
Clerk.

25, Waterloo Place, Edinburgh,
March 21, 1894.

LLANDUDNO IMPROVEMENT COMMISSIONERS

TENDERS FOR GAS COAL.

THE Llandudno Improvement Commissioners invite TENDERS for the supply of 4500 tons of COAL, capable of producing a minimum of 9500 cubic feet of 17-Candle Gas per ton, to be delivered (carriage paid), between the 1st of July, 1894, and the 30th of June, 1895, at the Llandudno Station of the London and North-Western Railway, in such quantities and at such periods as may be ordered from time to time.

Tenders, endorsed "Tender for Coal," to be sent to the undersigned not later than Tuesday, the 17th day of April, 1894.

The Commissioners do not bind themselves to accept the lowest or any tender.

A. CONOLLY,
Clerk to the Commissioners.

March 22, 1894.

ROCHDALE CORPORATION.

TO RETORT SETTERS AND OTHERS.

THE Gas Committee of the above Corporation invite TENDERS for the erection of 20 SETTINGS of INCLINED RETORTS, including the ARCHES.

Plans and Specification may be seen, and all necessary information obtained, on application to Mr. T. Banbury Ball, the Manager at the Gas-Works, to whom tenders (endorsed "Contract No. 9,") must be sent in not later than Noon, on Wednesday, April 4, 1894.

By order,
T. BANBURY BALL,
Engineer and Manager.

Gas-Works, Rochdale,
March 22, 1894.

ROCHDALE CORPORATION.

TO ENGINEERS, IRONFOUNDERS, AND OTHERS.

THE Gas Committee of the above Corporation invite TENDERS for the following IRONWORK:—

CONTRACT No. 10.—Structural IRONWORK for 20 Settings of Inclined Retorts, including Rolled Joists, Hoppers, Measuring Chambers, Stage, &c.

CONTRACT No. 11.—RETORT-FITTINGS, including Mouthpieces, Pipes, Hydraulic Mains, &c.

CONTRACT No. 13.—Cast-Iron TANK and CONNECTIONS.

CONTRACT No. 14.—1000 Yards 6-inch Spigot and Socket PIPES, turned and bored joints; weight, 90 lbs. per yard; coated externally only with Dr. Smith's Solution; and delivered free at Rochdale Station.

Plans and Specifications may be seen, and all necessary information obtained, on application to the undersigned at the Gas-Works, and to whom tenders, properly endorsed, must be sent in not later than Noon, on Wednesday, April 4, 1894.

By order,
T. BANBURY BALL,
Engineer and Manager.

Gas-Works, Rochdale,
March 22, 1894.

TENDERS FOR GAS-MAIN, ETC.

THE Directors of the Barking Gas Company invite TENDERS for the supply of about—
1600 yards of 12-inch CAST-IRON MAIN.
300 yards of 6-inch " "
1200 yards of 3-inch " "
And various CONNECTIONS.

The Directors do not bind themselves to accept the lowest or any tender.

A Specification can be obtained on application to the undersigned at the Company's Offices, 55 and 56, High Holborn, London, W.C.

By order,
J. HUSKISSON,
Secretary.

March 21, 1894.

TUNBRIDGE WELLS GAS COMPANY.

TO COAL FACTORS AND OTHERS.

THE Directors of the Tunbridge Wells Gas Company will be prepared on Tuesday, the 10th of April next, to receive TENDERS for the supply of 17,000 tons of either NEW PELTON, NEW TANFIELD, PELAW MAIN, EAST PONTOP, SOUTH HETTON, LONDONDERRY, or other approved GAS COALS, at the option of the Directors, to be delivered free into the Gas Company's Siding, on the South-Eastern Railway, at Tunbridge Wells, in accordance with terms and conditions, which may be obtained on application.

The tenders are to be sent to me by not later than Six o'clock p.m., on Tuesday, the 10th of April, marked "Tender for Coals."

The lowest or any tender will not necessarily be accepted.

By order,
JOHN READ,
Secretary.

Gas Company's Office, Tunbridge Wells,
March 16, 1894.

TENDERS FOR TAR.

THE Derby Gaslight and Coke Company are prepared to receive TENDERS for the purchase of the surplus TAR they will have for disposal during the Twelve Months ending March 31, 1895—viz., 2000 tons.

The Company may dispose of the total surplus of approximately 2000 tons, or part thereof, in one or more contracts, extending over Six or Twelve Months, as the Board may decide; but they do not bind themselves to accept the highest or other tender or tenders.

Tenders must be addressed to the Chairman of the Finance Committee of the Derby Gaslight and Coke Company, Friar Gate, Derby, endorsed "Tender for Tar," and delivered on or before Wednesday, the 28th day of March, 1894.

Further particulars may be had on application.

By order of the Directors,
RICHARD FISHER,
Secretary.

Gas Office, Derby, March 12, 1894.

In Paper Cover, Price 1s.

GASHOLDERS
WITH OR WITHOUT
GUIDE-FRAMING.

A DISCUSSION
BETWEEN
E. LLOYD PEASE & F. SOUTHWELL CRIPPS.

To which is added a Synopsis of all the Literature (English and Foreign) on Reducing or Abolishing the Guide-Framing of Gasholders, also the principal Literature on Gasholder Construction generally, compiled to March, 1893; with a List of all the English and Foreign Periodicals connected with the Gas Industry.

By F. SOUTHWELL CRIPPS.

LONDON:
WALTER KING, Office of the "Journal of Gas Lighting," &c.,
11, BOLT COURT, FLEET STREET, E.C.

Price 15s., Limp Cloth, the Thirteenth Yearly

ANALYSIS OF THE ACCOUNTS
OF THE
Metropolitan Water Companies,

Chelsea, East London, Grand Junction, Kent, Lambeth, New River, Southwark and Vauxhall, and West Middlesex—showing the Capital, Income, Expenditure, Profits, and Dividends per Million and per Thousand Gallons of Water supplied; the proportion of Expenditure and Profits to gross Income; and the Income, Expenditure, and Profits per House, &c., supplied for the year ended December 31, 1892, or March 31, 1893, together with the quantity of Water supplied, the estimated daily quantity supplied for domestic and other purposes, the quantity supplied per head of population, &c., &c., for the year ended December 31, 1892.

Compiled and arranged by
ALFRED LASS, F.C.A.

LONDON:
WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

HOLMSIDE GAS COALS.
(Wrought out of Holmside and South Moor Collieries.)

PRESENT production 4000 tons per working day. Area of coal about 5000 acres, including the largest remaining workable proportion of pure HUTTON SEAM GAS COAL. Analysis of HOLMSIDE GAS COAL *in bulk as shipped* gives 10,500 cubic feet of Gas per ton, of an Illuminating Power of 16¼ candles. The Sulphur is about 1 per cent., and the Ash 1¾ per cent. The Coal cokes well, and leaves about 70 per cent. of excellent Coke. To show the progress of HOLMSIDE COALS, it may be mentioned that the quantity carbonized by the London Gas Companies in 1885 was about 200,000 tons; whereas the present consumption of HOLMSIDE COALS in London alone is at the rate of nearly

600,000 Tons per Annum.

Full particulars on application to
MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-ON-TYNE.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD
BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, NEAR DEWSBURY.

COKE BREAKERS,
PRICES REDUCED.
(THOMAS & SOMERVILLE'S PATENT.)

New Design, with two Cutting Rollers, making less Breeze than their old pattern.

For Exhauster Advertisement, see last week.

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PARK STREET, SOUTHWARK, E.C.,
And at STROUD, GLOUCESTERSHIRE.

BOLDON GAS COALS.
Worked by THE HARTON COAL CO., LTD.
Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton	10,500	Cubic Feet.
Illuminating Power	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Ipswich Gaslight Company, Devonport Gas Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For prices, &c., apply to the
HARTON COAL COMPANY,
LIMITED,
Newcastle-on-Tyne.
W. H. PARKINSON,
FITTER.

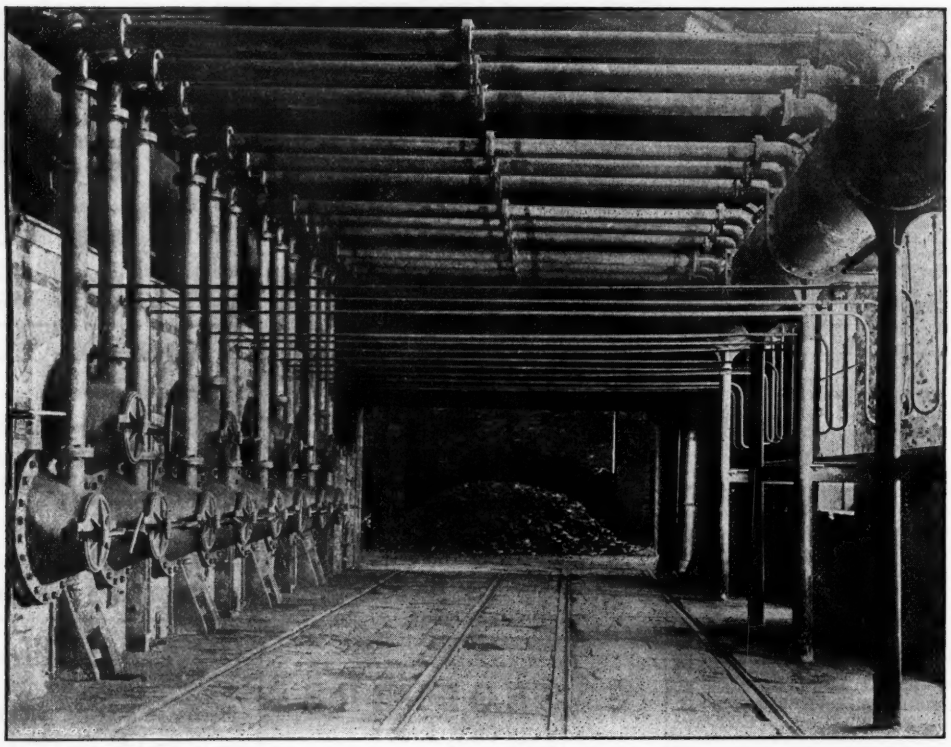
THE OIL-GAS ENRICHMENT COMPANY, Limited.

Registered Office: 28, Queen Street, Edinburgh. J. GORDON MASON, Solicitor, Secretary.

THE

PEEBLES OIL-GAS PROCESS.

(YOUNG & BELL'S PATENT.)



A. F. CRAIG & Co., Engineers, &c., PAISLEY,

AND

JOHN DENNIS, Contractor, &c., DALKEITH,

beg to intimate that they are authorized by the OIL-GAS ENRICHMENT COMPANY, LIMITED, to act as their

AGENTS FOR SCOTLAND.

They were connected with the original Installation at the Peebles Gas-Works, and also furnished and erected the plant at Galashiels, of which a view of the Retort-House (from a Photograph) is given above. They have also been connected with the erection of more than three-fourths of the total plant started previous to 1894, including that at Peebles and Galashiels (previously mentioned), Kelso, Musselburgh, Alloa, Innerleithen, Dalkeith, Penicuik, Lasswade, &c., all of which are giving the utmost satisfaction.

Having thereby gained considerable experience, they are now in a position to furnish particulars regarding the enriching of Coal Gas from Oils and Tars, in accordance with "THE PEEBLES PROCESS," the success of which has now been thoroughly proved.

They will be glad to prepare Drawings and give Estimates for supplying and erecting complete the necessary plant for the manufacture of Gas from Oils and Tars alone, or for the adaptation of the Oil-Gas Enriching Process to work in combination with existing Coal Gas Plant.

They hope to be favoured with inquiries from all those considering the adoption of this process in Scotland. All orders with which they are entrusted shall receive their best attention.

FOR FURTHER PARTICULARS, ESTIMATES, &C., ADDRESS TO EITHER OF THE ABOVE FIRMS.

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Proprietors of
BEST GLASSHOUSE POT & CRUCIBLE CLAY.
Shipments Promptly and Carefully Executed.

For **FIRE-BRICKS,** the most durable for **GAS-FURNACES,**
Address
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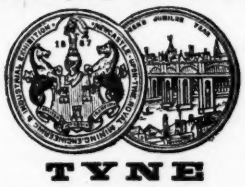

TYNE BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·68 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to
THOS. W. DANCE & SONS,
Coal Owners, Newcastle-on-Tyne
OR
E. FOSTER & CO.,
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Highest Results in Gas, & Excellent Coke.
QUOTATIONS ON APPLICATION TO
THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
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OXIDE OF IRON.
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NATURAL IRISH BOG ORE.
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Established 1872.

LONDONDERRY GAS COALS
FROM THE
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Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by
Mr. John Pattinson, F.C.S., F.I.S.
For Prices and Particulars, apply to
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THE SILICA FIRE-BRICK COMPANY,
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SILICA BLOCKS, BRICKS, AND CEMENT
OF SUPERIOR QUALITY
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Trade Mark: "SILICA."
These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their
GREATER DURABILITY
Strongly recommended where EXCESSIVE HEATS have to be maintained.

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CANNEL COAL MERCHANT,
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Prices and Analysis of all the Scotch Cannels on Application.

HEBBURN MAIN GAS COALS.
Yield of Gas per ton . . . . . 10,500 cubic feet.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.
For prices, f.o.b. Ship or Delivered by Rail, apply to
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FOR GAS AND WATER.
Pipes, One to Six inch Bore, kept in Stock. Also a very large assortment of all sizes of Bends, T-pieces, and Specials ready for despatch on receipt of Order.
VALVES
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TELEGRAMS: "PIPES GLASGOW."
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Worked by the
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OUT OF THEIR
THORNLEY AND WHEATLEY HILL COLLIERIES.
The Analysis made by Messrs. J. and H. T. Pattinson, Public Analysts for Northumberland, gives 10,500 cubic feet of Gas per ton, with an Illuminating Power of 16·3 Candles and 67·3 per cent. of Coke. The following is a Working Analysis made of these Coals by the Tudhoe and Sunderland Bridge Gas Company:—

[COPY.]
Tudhoe and Sunderland Bridge Gas Company.
Tudhoe Gas-Works,
Spennymoor,
8th June, 1893.

Messrs. The
WEARDALE IRON & COAL COMPANY, LTD.
Gentlemen,
For the last two months we have used your **THORNLEY GAS COAL** exclusively at these gas-works; and I have pleasure in herewith giving you the actual results obtained during the trial.
Yield of Gas per ton: 10,300 cubic feet.
Yield of Coke: 13½ cwt.
Illuminating Power of Gas, average of a series of tests, **17 Sperm Candles.**
The Coke was of excellent quality.
The following is a complete ultimate Analysis of the Coal.

	Per Cent.
Carbon	83·128
Hydrogen	5·116
Oxygen	7·401
Nitrogen	0·585
Sulphur	0·620
Ash	3·130
Water	0·020
	100·000

Analysis of the Coke.

Carbon	93·31
Sulphur	0·61
Ash	5·00
Moisture	1·08
	100·00

I am, Gentlemen,
Yours truly,
A. B. Cowan,
Manager.

For Price, &c., apply to the
WEARDALE IRON & COAL Co., Ld.
QUAYSIDE, NEWCASTLE-ON-TYNE.

FOR **TUBES AND FITTINGS** APPLY TO

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Proprietors of

ALDWARKE MAIN CAR HOUSE & ROTHERHAM MAIN COLLIERIES, NEAR ROTHERHAM.

ALDWARKE MAIN GAS COAL

Analysis: 12,600 feet of 19-candle gas per ton.

Weight of illuminating power in pounds of sperm, 820·80. Very free from impurities.

Telegrams: "ATLAS SHEFFIELD."

THE "IDEAL" RETORT.

YEADON REVOLVING GAS-RETORTS.

(Yeadon and Adgie's Patents.)

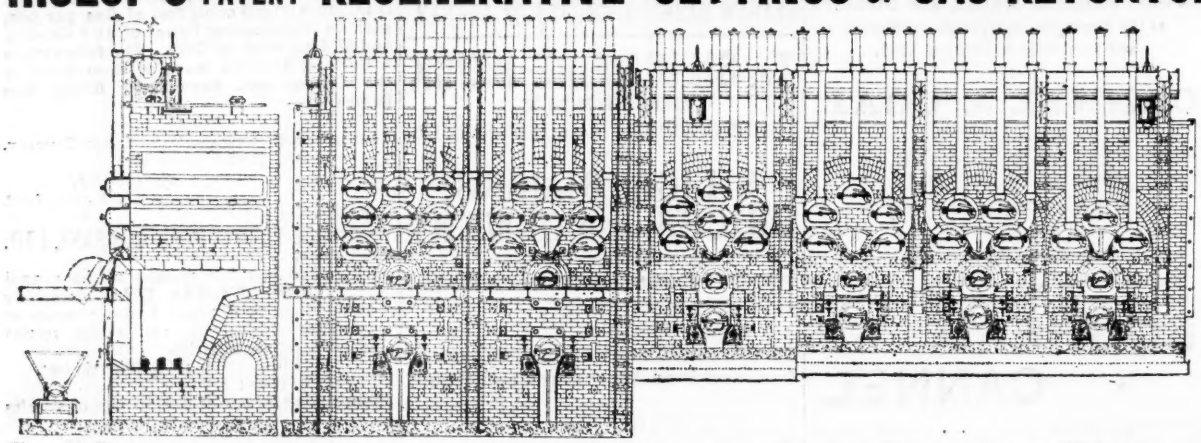
FULL PARTICULARS AND ESTIMATES GIVEN BY

THE YEADON GAS-RETORT SYNDICATE, LIMITED,

4, ALBION PLACE, LEEDS;

Or their Sole Representatives: D. M. NELSON & SONS, 68, Bath Street, GLASGOW.

HISLOP'S PATENT REGENERATIVE SETTINGS OF GAS-RETORTS.



THESE SETTINGS ARE ADAPTED TO THE REQUIREMENTS OF ALL GAS COMPANIES AND GAS CORPORATIONS, AND HAVE ALREADY BEEN VERY EXTENSIVELY ADOPTED. THEY ARE ERECTED UPON BOTH THE WORKING-STAGE AND SHALLOW-CHAMBER SYSTEMS, AND EQUALLY SATISFACTORY RESULTS ARE GUARANTEED IN BOTH CASES.

THE SETTINGS HAVE ATTAINED TO A MEASURE OF SUCCESS AND POPULARITY QUITE UNEQUALLED BY THAT OF ANY OTHER WITHIN THE SAME SPACE OF TIME. THE WORKING RESULTS OBTAINED, AND THE GENERAL SATISFACTION GIVEN, ARE DECLARED IN EVERY CASE TO EXCEED, AND IN MOST CASES CONSIDERABLY EXCEED, THE PATENTEE'S GUARANTEE. THE CONSTRUCTION AND WORKING OF THE PATENT PRODUCER AND THE PATENT CHARGING APPARATUS FOR SAME ARE ABSOLUTELY UNIQUE AND UNRIVALLED, AND ARE THE DELIGHT OF EVERY STOKER; WHILE IN EVERY OTHER PARTICULAR THEY SECURE THE HIGHEST RESULTS ATTAINABLE BY ANY REGENERATIVE SYSTEM, AND AT A MINIMUM OF COST.

Drawings and Specifications are furnished for the complete erection of Ovens, with or without Retort and Bench Mountings, or complete erection undertaken if required, and carried out by specially Trained Workmen.

Further particulars may be obtained on application to the Patentee's Agents: C. M. HAMILTON, 5, Stuart Street, Shawlands, Glasgow; J. E. FISHER, Stourbridge; JOHN WALSH & SONS, Retort Builders, Halifax, Yorkshire; RICHARD TURNER, Retort Builder, Denton, Lancashire; and from the Principal Agent, R. F. HISLOP (son of Patentee), Gas-Works, Paisley, N.B.

HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine quâ non* TO THE SATISFACTORY WORKING OF THE HYDRAULIC MAIN UNDER THE REGENERATIVE AS WELL AS OTHER SYSTEMS OF RETORTS. BEING LARGELY ADOPTED, AND AFFORDING THE HIGHEST SATISFACTION.

SPENT LIMES NO LONGER WASTE PRODUCTS

Under G. R. HISLOP'S Patents, all Spent Limes are most effectually, economically, and continuously recovered at from one-third to one-half the cost of New Lime. The results are a surprise to all who have inspected the process, and are entirely satisfactory to all now using it.

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MANUFACTURERS OF EVERY DESCRIPTION OF
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PLANS and SPECIFICATIONS furnished for **Extensions** and **Enlargement** of existing **Works,** adapting them to the most **Improved** and **Modern Principle** of **Gas Manufacture.**

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Makers, by permission of that eminent authority **MR. GEORGE LIVESEY,** of his **CELEBRATED PATENT WASHER,** highly approved by all the Engineers of Works where adopted. Largely in demand.

Special reference and attention are invited to our

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which have acquired a high reputation for the **excellence** of Materials and Workmanship; their **durability** and **accuracy** of **Register** guaranteed. They are used by several of the **London Gas Companies,** and over **200 Provincial Gas Companies.**

Price Lists, Specifications, and Estimates provided for any work appertaining to Gas Lighting, from the Retort-House to the Drawing-Room.

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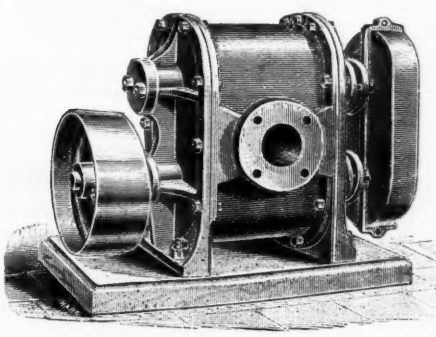
DRUM PUMP AND GAS EXHAUSTER.

The Pump of the future for quickly and economically moving large bodies of Water.

The force of the Piston Pump with the capacity of the Centrifugal combined.



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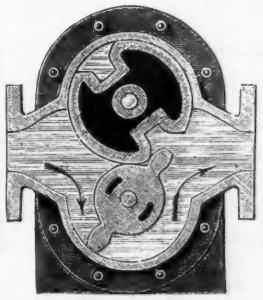

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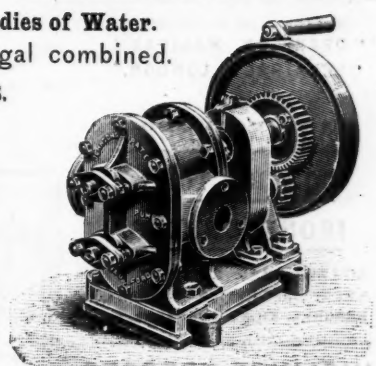

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The United Gas Improvement Company, U.S.A.

A. G. GLASGOW, M.E.,
Late General Inspector,
The United Gas Improvement Company, U.S.A.

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Contracting Engineers for Water Gas Plant,
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Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

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And to the following Gas Companies and Corporations—

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GAS ENGINEERS,
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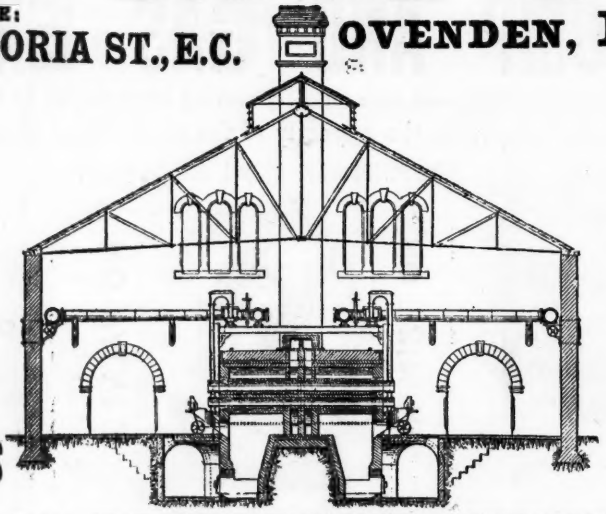

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REGENERATOR AND GENERATOR FURNACES ON DRAKE'S, FRITH'S SIEMENS'S, KLONNE'S, HASSE'S VALON'S, SOMERVILLE'S, PONSARD'S and other Principles.

INCLINED RETORTS

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HEATHCOTE GAS COAL.

RICH IN ILLUMINATING POWER AND YIELD OF GAS.
ABOVE THE AVERAGE IN WEIGHT AND QUALITY OF COKE.
MAINTAINS A HIGH STANDARD IN RESIDUALS.

THE GRASSMOOR Co., Ld., CHESTERFIELD.

CLAYTON SON & Co LTD

MAKERS OF

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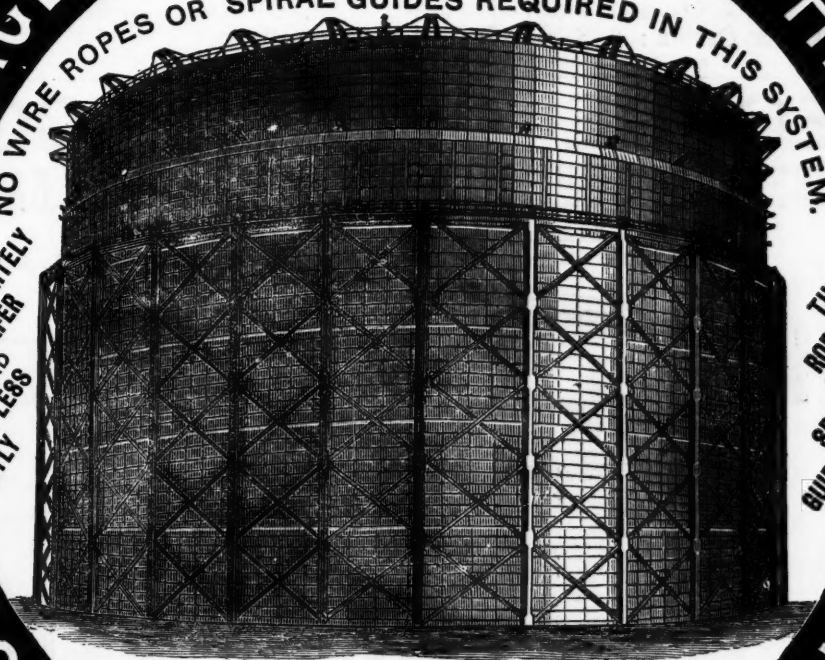
THE LARGEST GASHOLDER IN THE WORLD.

CAPACITY 12 MILLION CUBIC FT.

GASHOLDERS OUR SPECIALITY

NO WIRE ROPES OR SPIRAL GUIDES REQUIRED IN THIS SYSTEM.

INFINITELY SAFER AND FAR LESS COSTLY THAN ROPES OR SPIRAL GUIDES.



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IT HAS SIX LIFTS 30 FT DEEP EACH AND IS 300 FT DIAR

MAKERS OF GAS PLANT OF EVERY DESCRIPTION

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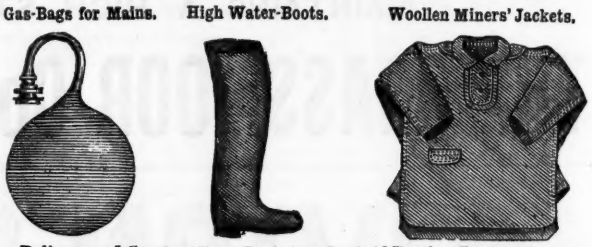

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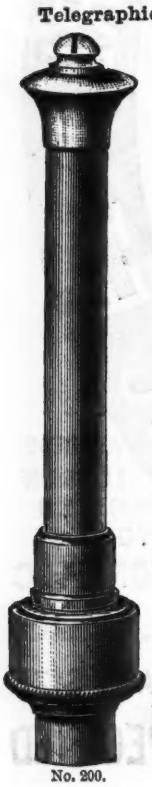

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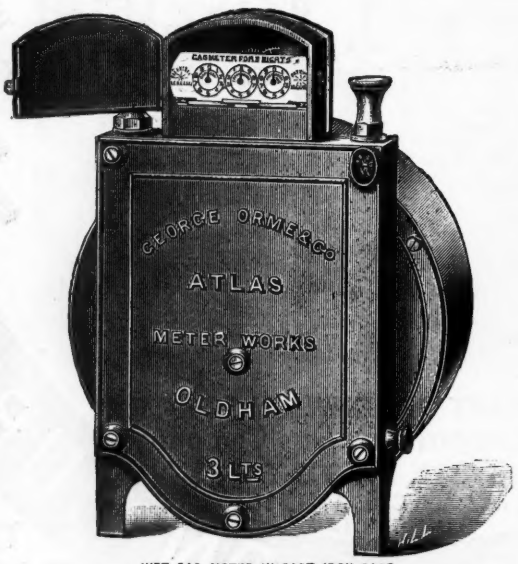
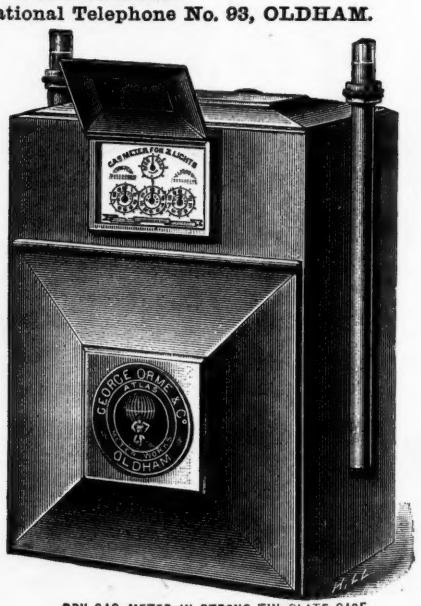


WET GAS-METER IN CAST-IRON CASE.



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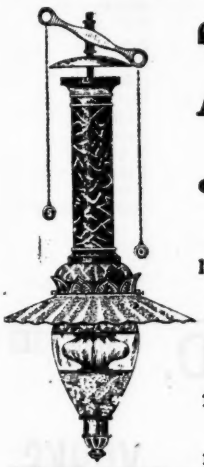

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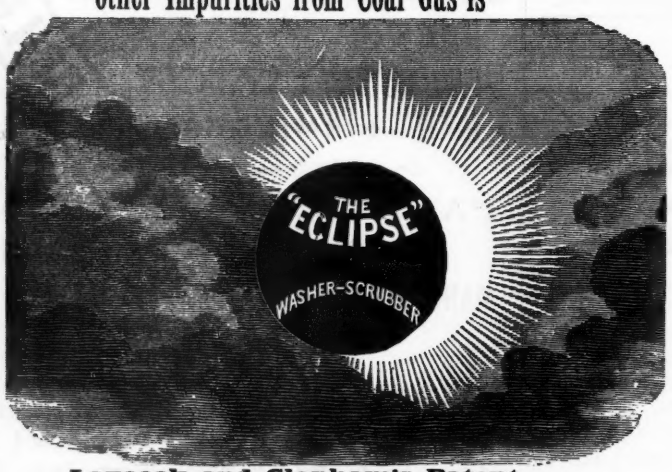

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